MARINE REVIEW

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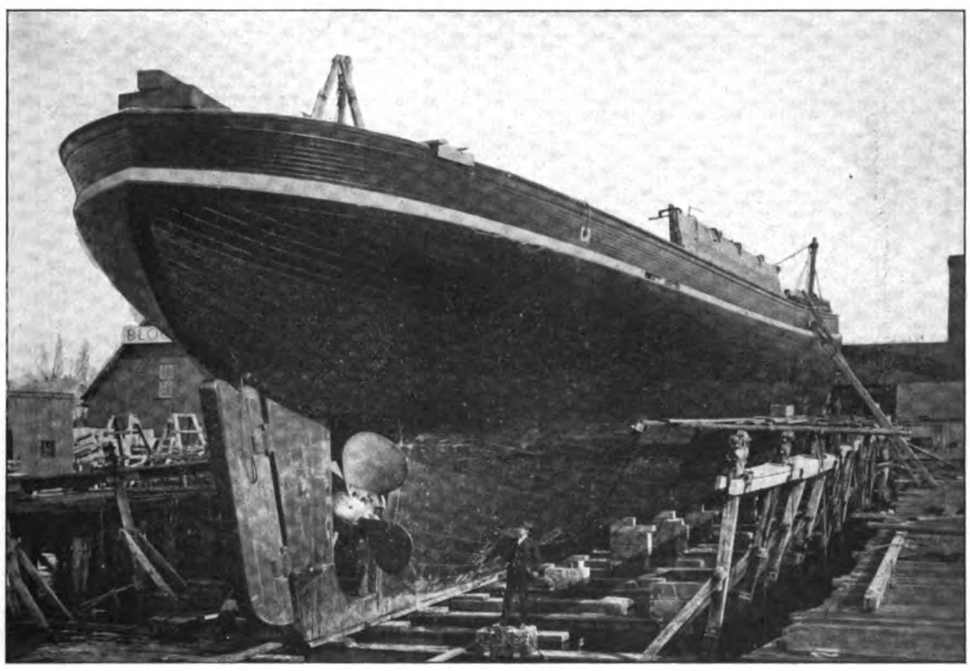
Peary's Arctic Exploration Ship

Peary's new arctic ship, the Roosevelt, now receiving her machinery and finishing touches at the hands of the Portland Co., Portland, Me., preparatory to being brought around to New York for "fitting out" in the fore part of June next, is a remarkable craft, unique in part, and at the same time combining all the experiences of arctic craft to date. She was designed by William E. Winant, naval architect, Washington, D. C., and her hull was built by McKay & Dix, Bucksport, Me. In his latest and what is to be his final effort to reach the North Pole, Com'dr Peary has united the fruit of his own experience in the past, together with the difficulties which have confronted his rivals in the forbidding, albeit fascinating field of geographical research.



THE PEARY ARCTIC EXPLORATION SHIP ROOSEVELT ON THE STOCKS.

[*Copyright applied for by W. H. Gay.*

This last arctic ship is naturally very remarkable in many ways. Physical hardiness and a determined spirit to buck against the seemingly insuperable difficulties presented by the icy barriers of the far north are not enough, as past experience has proved, to reach the North Pole. The prime question, even despite the intense cold, is one of provisioning, and successful provisioning demands that supplies be carried to the north to the utmost limit of navigation and in sufficient quantity to last at least two years. To carry so large a mass of stores into and through the many obstructive leagues of dodging ice floes in a minimum coal-consuming vessel, calls for a craft of peculiar qualities. The vessel must be large enough to carry a coal supply that will insure her steaming endurance through months of isolation from the coal heaps of civilization. She must be able to carry all of the edible supplies, clothing and special equipment demanded by her personnel. She must carry parts and ship's stores enough to last for two years. For this rigorous work calls for continual repairs, which are at times vital to the welfare of the entire expedition. Finally, the craft must be strong enough to pound, pound, and pound for months at a time against the ice-bound channels of that inhospitable region. Experience has demonstrated that the sturdy whalers, stout as they are, are not strong enough for this persistent attack, and, to provide for this almost disheartening work, this new ship was especially designed and constructed.

The model of the hull is rather bluff and lies fairly low in the water and is suggestive both of strength and capacity. Probably in no part of the world can be found a model or form of hull similar to this vessel, whose mission is to drive into,

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break down and force away the ice fields in front, with a stern so shaped that the overhanging portion will more or less protect the screw when the heavy ice floes come together against the vessel's quarters. There is no "tumble-home" of the top sides such as may be found in former arctic vessels, but instead the top sides "flare out" up to the rail, which admits of working a very heavy guard strake.

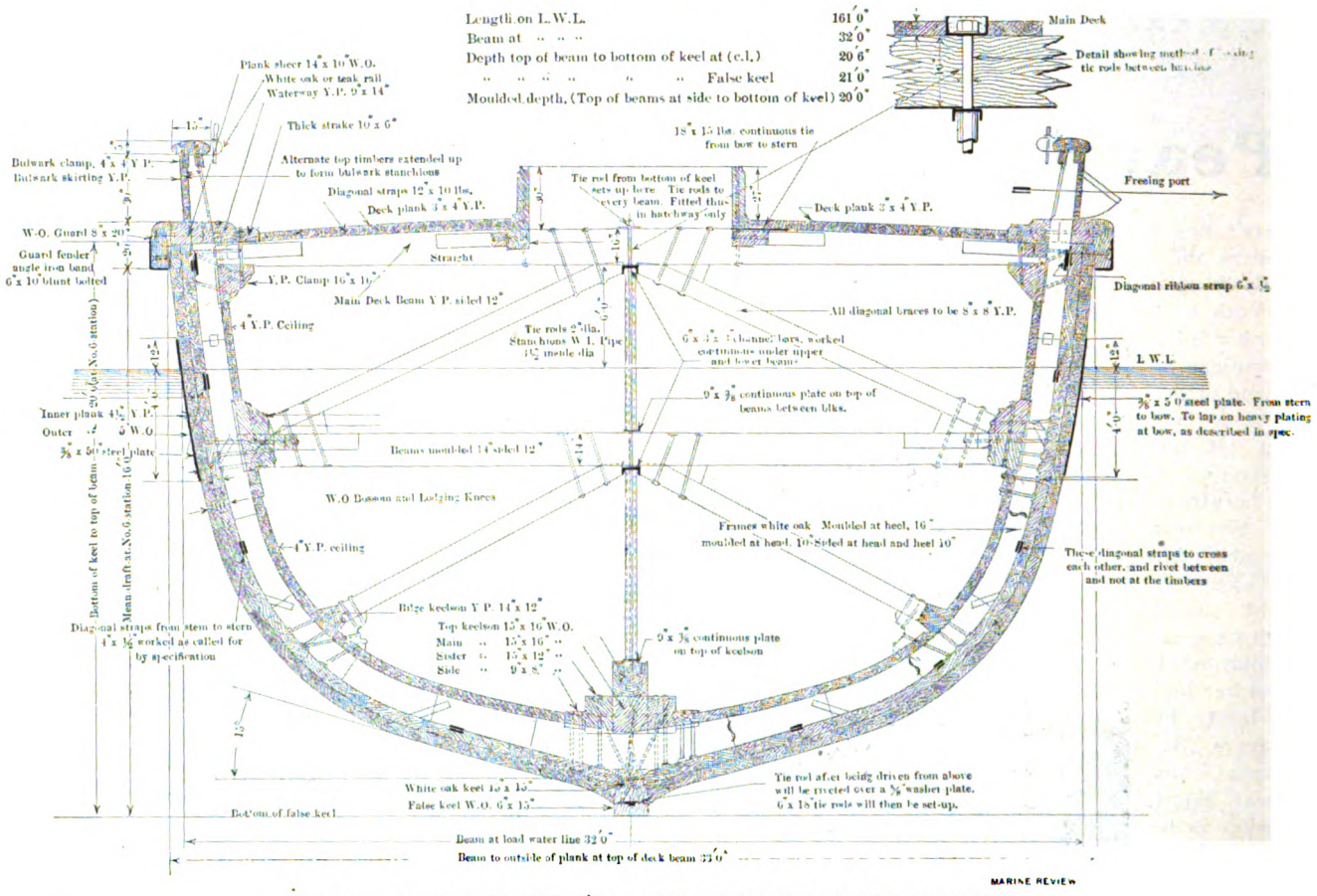
The purpose of this guard strake, apart from being a buffer, is to help lift the vessel out of the water as the ice crushes about her. As can be seen, the ice will press against her sides, and then, as they offer first resistance, it will rise and catch under the counter or overhang of this guard and bodily raise the vessel. In case the ship, on the other hand, has been frozen in a thick pack of ice and it is desirable to free her, hydraulic jacks are set upon the ice and brought to bear upon the under side of the guard, and these, in turn, will raise the craft, and as she is permitted to settle back, her own weight

mous pressure from the surrounding fields of ice. This "squeeze" of the ice will tend to lift rather than crush her between the grasp of the gathering pack. The extreme "ferry-boat" form of midship section will raise her up out of the ice the harder the squeezing becomes.

The vessel is technically described as a "three-masted, fore-and-aft, schooner-rigged vessel, with auxiliary sail power." She is larger than Nelson's famous "Fram" but about the size of the antartic ship Discovery. There the similarity ceases, and in order that our readers may have a better notion of the bulk and build of this unique craft, it will be well to give some of her dimensions as follows:

Length on load water line (between perpendiculars) . 161 ft.
Length on deck (about) . . . . . 172 ft.
Length over all, from tip to tip of rail (about) . . . . 182 ft.
Breadth, molded (to outside of plank at deck beam) . 33 ft.
Breadth to outside of plank, at L. W. L. . . . . 32 ft.

PRINCIPAL DIMENSIONS


Length on L.W.L. 161'0"
Beam at " " " 32'0"
Depth top of beam to bottom of keel at (c.l.) 20'6"
" " " " " " False keel 21'0"
Moulded depth. (Top of beams at side to bottom of keel) 20'0"
Main Deck
Plank sheer 14"x 10" W.O.
White oak or teak rail
Waterway Y.P. 9"x 14"
Thick strake 10"x 6"
18"x 15 lbs. continuous tie from bow to stern
Bulwark clamp, 4"x 4" Y.P.
Bulwark skirting Y.P.
Alternate top timbers extended up to form bulwark stanchions
Diagonal straps 12"x 10 lbs.
Deck plank 3"x 4" Y.P.
Tie rod from bottom of keel sets up here. Tie rods to every beam. Fitted thus in hatchway only
Freeing port
W.O. Guard 8"x 20"
Guard fender angle iron band 6"x 10" blunt bolted
Straight
Y.P. Clamp 16"x 10"
Main Deck Beam Y.P. sided 12"
4" Y.P. Ceiling
Tie rods 2" dia. Stanchions W. I. Pipe 4½" inside dia
All diagonal braces to be 8"x 8" Y.P.
6"x 4"x 7/16" Channel bars, worked continuous under upper and lower beams
Diagonal ribbon strap 6"x 1/2"
L.W.L.
9"x 3/8" continuous plate on top of beams between bilks.
3/8"x 5'0" steel plate. From stern to bow. To lap on heavy plating at bow, as described in spec.
Inner plank 4½" Y.P.
Outer " 5" W.O.
3/8"x 5'0" steel plate
Beams moulded 14" sided 12"
W.O. Bosom and Lodging Knees
Frames white oak. Moulded at heel, 16" moulded at head, 10" Sided at head and heel 10"
4" Y.P. ceiling
These diagonal straps to cross each other, and rivet between and not at the timbers
Bilge keelson Y.P. 14"x 12"
Top keelson 15"x 16" W.O.
Main " 15"x 16" "
Sister " 15"x 12" "
Side " 9"x 8" "
Diagonal straps from stem to stern 4"x 1/2" worked as called for by specification
9"x 3/8" continuous plate on top of keelson
Bottom of keel to top of beam
Mean draft at No. 6 station 16'0"
White oak keel 16"x 15"
False keel W.O. 6"x 15"
Tie rod after being driven from above will be riveted over a 3/8" washer plate. 6"x 15" tie rods will then be set-up.
Bottom of false keel
Beam at load water line 32'0"
Beam to outside of plank at top of deck beam 33'0"
MARINE REVIEW

MIDSHIP SECTION OF PEARY'S ARCTIC EXPORATION SHIP ROOSEVELT.

and her form, acting as a big wedge, will tend to break a way clear. This is a peculiarly novel arrangement.

Reference to the midship section and the lines will show the combination in form of the old line "frigate floor," and the modern ferry boat bilge, which together gives a body that will admit of the vessel laying over on her side without damage and also gives what is known in ship parlance as a "freeing section" from lateral compression of the ice from without. The most important feature of this vessel's form is the bow and "fore-foot." This is designed so that when driving into thick ice the vessel will ride upon the ice and break same down, and at the same time keep the broken ice from piling too high as to be an impediment to the next ramming. The extreme flare of the bows from the water line to the forecastle deck is also for this purpose.

Of the form indicated above, braced, girded and re-enforced as never was craft before, she will be able to withstand enor-

Breadth, extreme, over guard . . . . . 34 ft. 2 in.
Depth, molded (from top of main deck beam at side to bottom of keel at midship frame) . . . . . 20 ft.
Draught, forward . . . . . 15 ft. 3 in.
Draught, aft . . . . . 16 ft. 9 in.
Mean draught, midships . . . . . 16 ft.

Her displacement, when ready for sea, and with all coal and stores aboard, will be about 1,500 tons.

CONSTRUCTIVE DESCRIPTION OF THE ROOSEVELT.

The vessel is divided fore and aft into five watertight compartments, any one of which is of sufficient reserve buoyancy to keep the vessel afloat in case of serious puncture below the waterline. All frames are spaced 24 in. apart from the stem to the stern with the exception of the "cants." Just aft of the fore-foot is the first bulkhead between the foremast and the bow framing, the forward space thus formed is the fore-peak, in which will be carried miscellaneous stores and pro-

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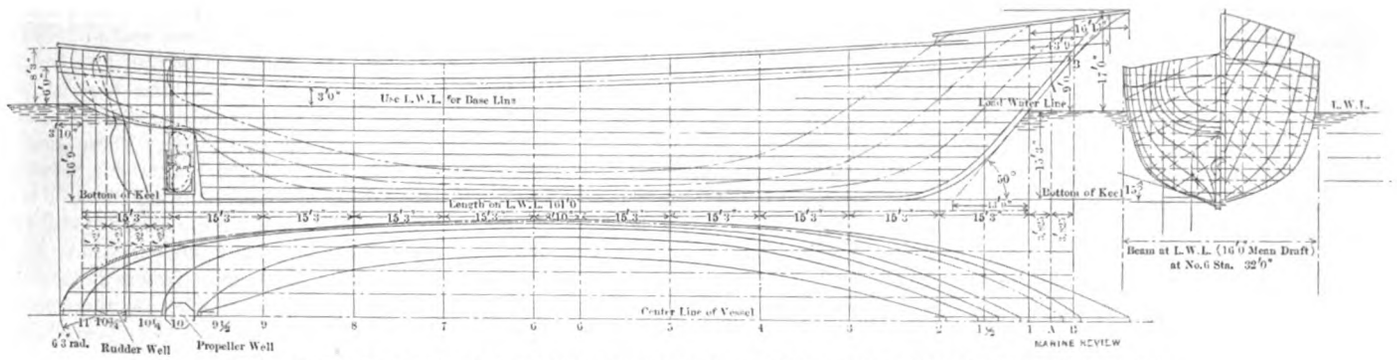
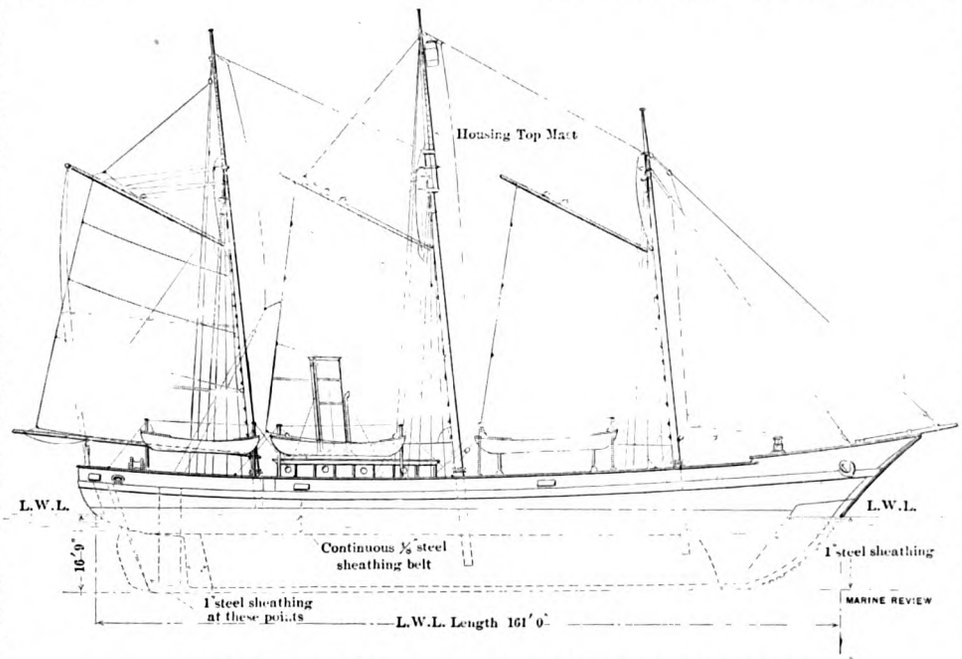


SHEER, HALF BREADTH AND BODY PLAN OF PEARY ARCTIC EXPLORATION SHIP ROOSEVELT.

visions peculiar to polar expeditions. Between the fore-peak and the boilers is the "fore-hold." This will be used exclusively for coal, in addition to that carried on the deck in bags.

As may be noted by reference to the inboard profile, the engines and boilers are located in one compartment, between the fore-hold and the transom bulkhead at the forward side of the propeller well. In addition to the machinery in this space, a considerable amount of deck stores will be carried in the 'tween-decks spaces, just aft of the engine on the forward side of the transom bulkhead. The lazarette is formed by the transom bulkhead, referred to above, and a considerable amount of stores can be carried there, but it will be mostly for deck use in working ship.

All of the spaces below deck can be reached by independent hatches from the main deck, and, with the exception of the lazarette, all holds are communicating by means of small watertight doors in the upper part of the bulkheads, thus affording means of fore and aft communication below the main deck in case it is not practicable or desirable to open the main deck hatches when once the serious work of the expedition has commenced



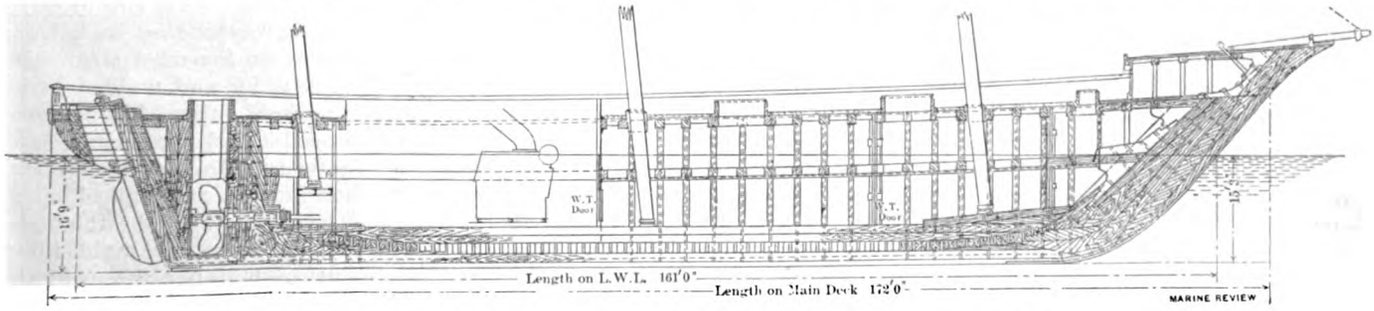
SAIL PLAN OF PEARY ARCTIC EXPLORATION SHIP ROOSEVELT.

The space inside the top-gallant forecastle affords excellent shelter for the Eskimos, their dogs and outfit. However, as the Eskimos will not be taken on board until the Roosevelt is almost beyond civilization, additional space is thus provided for stores. The forward deck house, while portable to the ship as a whole, is also portable in itself, and may be taken ashore, and contains a mess and lodging room in the center, with single and double state rooms along the sides for Com'dr Peary and the scientific members of the expedition. As will be noted from the inboard profile, the after deck house is stationary to the vessel and covers almost the entire space over the machinery. In this house will be the crew's quarters, and in the forward end of same an excellent galley has been provided.

One of the first things that strikes the seafaring man as missing from this remarkable vessel is the water tanks, which is accounted for by the fact that fresh water can be had in plenty in the polar regions, and for that reason the distilling plant is small, thus saving much valuable space that otherwise would have been consumed by the tanks.

That the vessel will stand a tremendous pounding from the ice floes is evidenced by the extraordinarily heavy bow framing described below:

The stem is molded clear of the rabbit line, of heavy plank 9 in. and is sided 16 in. As this stem is independent of the



INBOARD PROFILE OF PEARY ARCTIC EXPLORATION SHIP ROOSEVELT.

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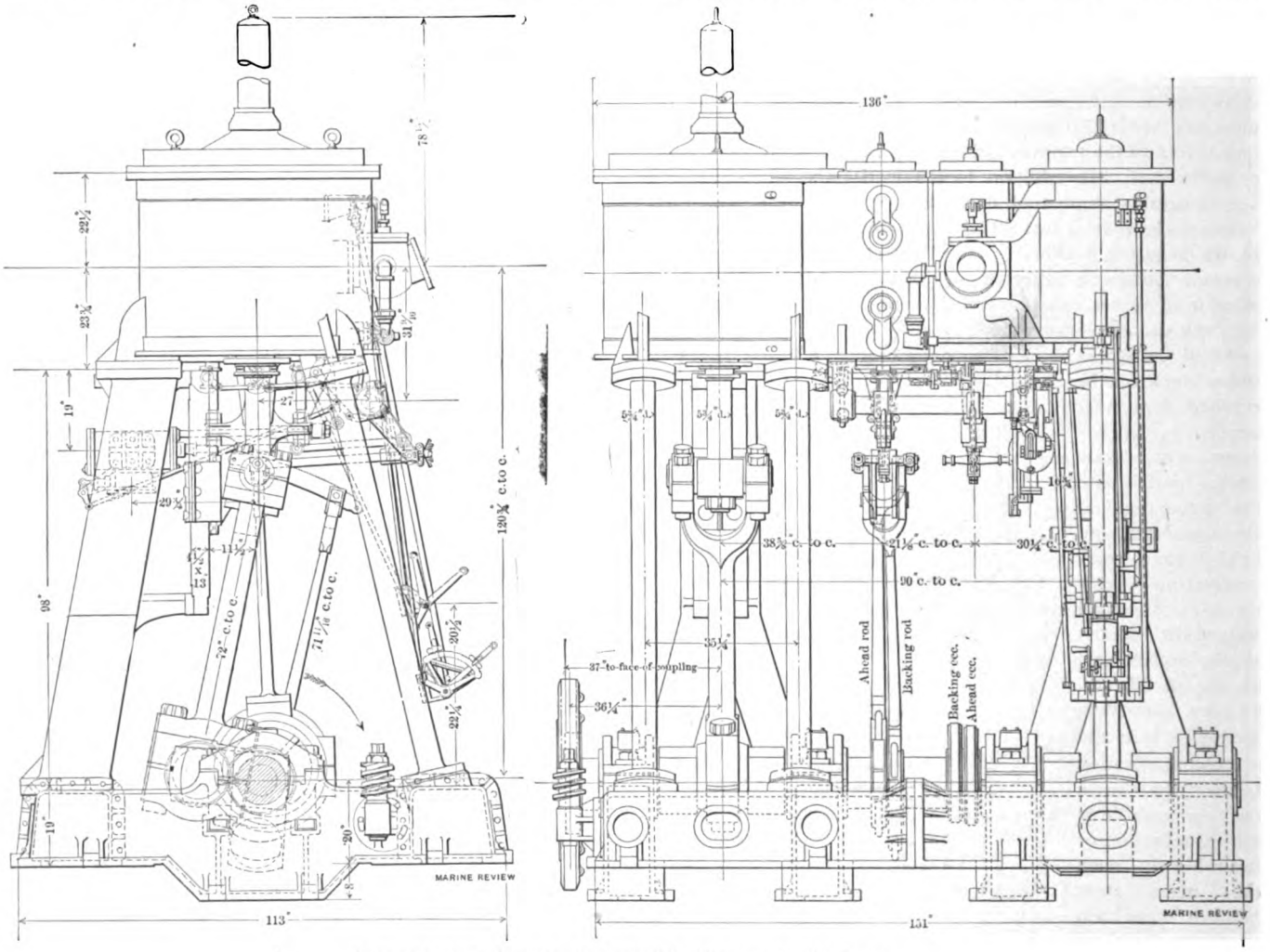
solid bow framing and is bolted into the same, it will be seen that if crushed or broken by the ice the main bow framing inside the rabbit line may still remain intact. On the after side of the stem and worked parallel to same are the stem timbers and deadwood. The first piece is molded 24 in., the second timber 21 in., the third and fourth timbers 18 in. This gives a solid framing of oak back from the stem of about 7 ft. 6 in. The first piece extends from the fore-foot up to the under side of the forecastle deck, where it is securely kneed to the forecastle deck framing, and the lower end scarphed into the outer fore-floor and securely held by natural crook timber, as indicated in the inboard profile. As may be seen from the plans, the second, third and fourth timbers taper toward the top and stop at the main deck beams, being securely kneed and bolted to same. The lower ends of these timbers

On the outside of the stem proper is a 1½-in. by 16-in. "stem band" extending from the main deck line down and to about 10 ft. aft of the fore-foot. From the fore-foot up to within about 6 ft. of the waterline this stem band has horizontal clamp V-shaped steel bands extending from one side around the stem band to about 3 ft. on the other side. These steel bands will take a great deal of pounding day after day before they will become loosened from the heavy through bolts. A significant feature of the bow framing is the bolting of the stem timbers; these are bolted one-after-the-other fashion, so that should the outer steel bands and stem timbers be completely smashed from constant contact with the ice, the inner bow timbers and steel apron still remain.

In the design and construction of this vessel the aim has been to provide a structure that will take the shock of the



THE ENGINE OF THE ROOSEVELT, 24 AND 52 BY 30 IN.

scarph into the inner and outer fore-foot timbers. While the molding size of all these timbers at the waterline is given above, it may be seen that this molding increases at the lower ends, where the strength is required while ramming, and diminishes at the heads in order that weight may be saved. The total siding of stem is 16 in. is held only at the stem rabbit, this being increased to about 4 ft. in wake of the after side of the fourth timber or deadwood.

As an additional strengthening to the entire bow framing, a vertical steel apron plate, ¾ in. thick, is worked on the inside on the deadwood timbers and extends from the throat of the fore-foot timbers up to the main deck beams; this in turn is braced on the inside by hanging and bosum knees between the main and "'tween deck" beams and re-enforced at the foot by the center vertical keelson.

impact "all over" and not locally at the bow, or amidships, as may be noted from the very heavy scantling of the main keel, also the main, top, sister and side keelsons, and to carry out this idea additional outer keelsons extending back from the fore-foot are fitted directly under the foremast step. The main keel is of white oak, is sided 16 in. and molded 15 in. clear of the frame. This keel is worked in three lengths from the fore-foot to the propeller post and joined together by hook scarphs, keyed athwartships. On the outside of this main keel is worked the false keel in short lengths and spiked on so that no harm will be done if same is ripped off by the under floes of the ice. This false keel is also white oak, molded 6 in. and sided 16 in. for the whole length, but unlike the main keel it is butted and not scarphed.

The main and top keelsons are of white oak, are sided 16 in.

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and molded 15 in. and fitted in two lengths with hook scarphs 6 ft. long, and with three nibs to each scarph. These scarphs are fitted with athwartship locust keys and, as the top keelson is fitted directly on top of the main keelson and is through bolted from the bottom of the main keel, it may be noted that the total molded depth from the bottom of this main keel to the top of the top keelson will make a very efficient backbone for the vessel.

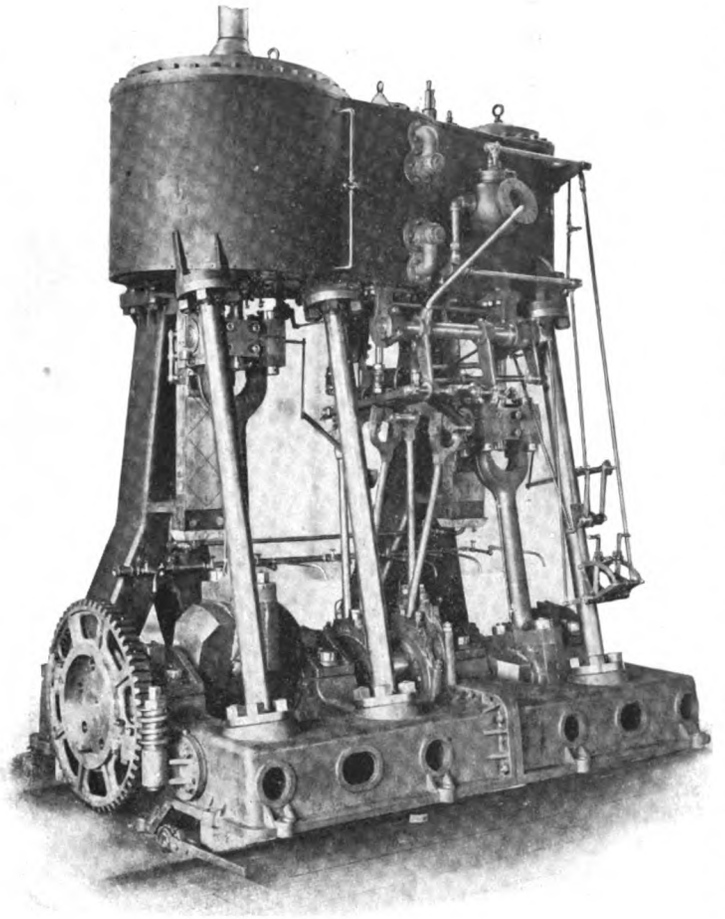
Additional longitudinal strength is added to the backbone of the vessel by "sister" and by the "side keelsons." These side keelsons are of white oak, worked "jogged" down over the frame alongside of the main keelson and are molded 16 in. and sided 15 in. All of these keelsons are bolted together, both horizontal and vertical, with all butts of keelson located half way between the butts in the adjacent keelsons.

At the ends of the vessel the keelsons are securely held in position by natural "crook-knees," also bolted from all directions. Another feature of this framing is the knight-heads and hawse timbers. The heels of these timbers are boxed into the deadwoods and aprons about 2 in. and are of white oak, securely bolted to alternate sides of the aprons by 1-in. galvanized iron through bolts, and also by heavy blunt bolts, and are worked in conjunction with the "bow cants." These bow cants are worked as solid at the bows as the molding at this point will allow and are thoroughly bolted from all directions. The counter timbers at the stern post, together with the "after cants," show that the framing of these after portions of the vessel has received consideration in view of the constant pounding that the quarters will receive from the floe ice. All counter timbers and cants are of white oak, are tenoned into the stern post and framing, and into the plank sheer, are also boxed, tenoned and let into the outer and inner stern posts. These counter timbers are bolted from all directions, and, judging from the almost solid framing from a point about 20 ft. forward of the propeller posts to the counter of the stern, it would seem that with this very heavy framing and the form of the vessel at this point, the Roosevelt should lift up and free herself should the squeeze aft become too great.

All this framing, both at the stem and stern and amidships, is securely tied by breast hooks, deck hooks, bosum and lodging knees, also hanging knees and chocks, arranged in every possible manner to prevent any of the timbers or framing from "starting" by compression from any point on the outside of the hull. After the framing was set up and fastened, 6 in. by 1½-in. iron head, bottom and diagonal bilge straps were worked all around the vessel and let in flush with the outside of the frame.

EXTRAORDINARY HEAVY PLANKING.

From the stem timbers to the stern posts this vessel has two courses of plank, the outer thickness, 5-in. oak, the inner course, 4½-in. spruce, this was selected for its lighter weight; both courses are edge-bolted in addition to the through bolting, and are worked independent of each other, including the bolting, calking and watertightness. The inner course was worked in lengths of from 35 to 40 ft. and was through-bolted from the outside and the bolts riveted on the inside of the frame and ceiling. This course was then calked and completely finished all over. On the flat of the floor and on the top sides this planking was worked about 12 in. wide to obtain all the strength possible. After the completion of this inner course, a layer of tarred hemp felt was worked over the entire surface to insure absolute watertightness. The outer course of 5-in. oak plank was then put on, with the butts of same held about in the middle of the length of plank to the inner course. This outer course was worked about as described above for the inner planking and was fastened on every frame with wrought iron galvanized through bolts, also blunt bolts in addition to the edge fastening. This outer course of planking will be subjected to a greater bruising, and will take most of the indentations from the solid and floe ice.



ENGINE OF THE PEARY ARCTIC EXPLORATION SHIP ROOSEVELT.

The bulwark and rail of this craft is as strongly constructed as other parts of the vessel, and is formed by the alternate top timbers extending up 3 ft. above the deck plank with a 15 x 5-in. white oak rail extending from stem to stern. This rail throughout is hooked-scarphed. Abreast the masts the rail is swelled out to form pinrails for belaying the running rigging.

DECK CLAMPS.

No little part of the strength of this vessel is obtained by the very heavy deck clamps of yellow pine which are molded and sided 16 x 16 in. These clamps extend almost the entire length of the vessel and are through bolted to the deck thick strakes, and through top timbers of the frame, in addition to being kneed to the main deck beams.

Just below the water line, abreast the 'tween deck beams, similar clamps are worked double (see midship section) one on top of the other, both of yellow pine, the lower being 16 x 16 in. and the upper 14 x 16 in. The 'tween deck beams are "tumbled" into the lower of these two clamps, while the upper diagonal beam braces are boxed into the upper clamp. To prevent the starting of the 'tween deck beams, bosum and logging knees of hackmatack are worked on each side of the beam, connecting same to clamp. The bilge clamp, which takes the foot of the lower diagonal braces which are fitted on every beam, is also of yellow pine, is molded 14 in. and sided 12 in. The forecastle clamps are not as heavy scantling as those for the main deck, but same are not subjected to the same work-

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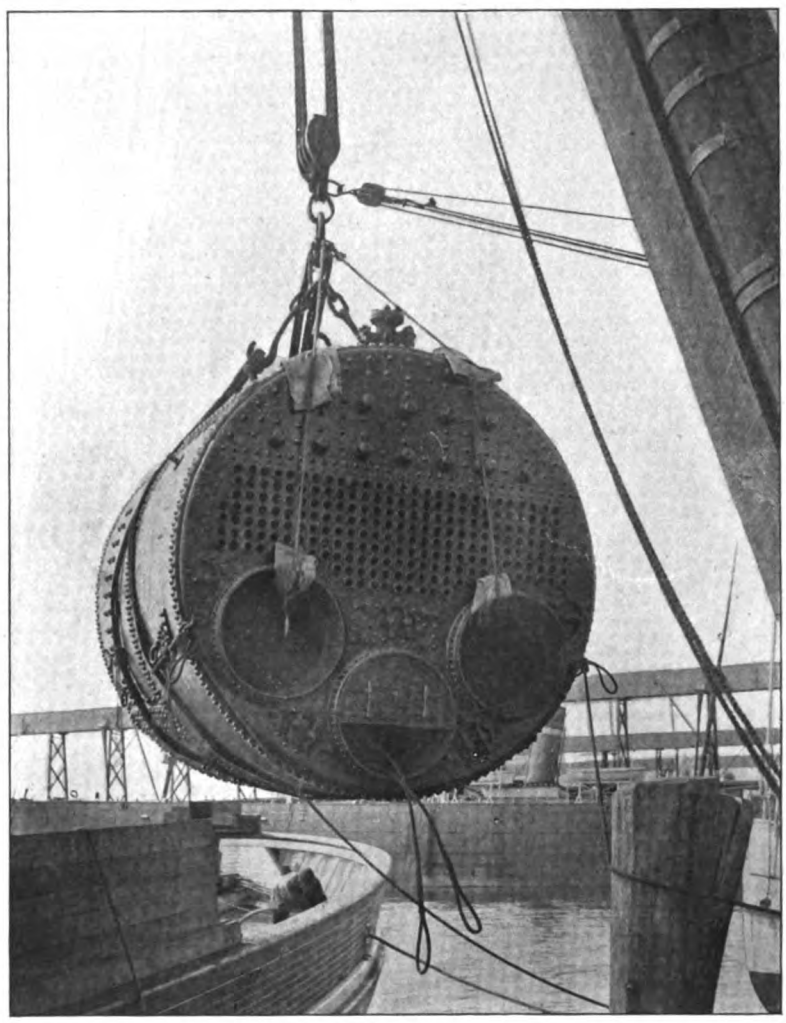
ing strain as the main deck. The framing in this part of the vessel shows, however, that strength only was considered.

WOOD AND LIQUID FILLING.

A very interesting feature of this entire framing is the filling between the frames and the timbers, every opening between the timbers, futtocks and top timbers, cants, etc., is filled in solid to the plank sheer with a liquid filling. After the plank had been worked and fastened, a liquid filling of sawdust and marine glue was poured down in all cavities from the top sides, so that between the inside course of the plank and the ceiling, the frame has been made a solid watertight structure in itself.

DECK BEAMS.

One is apt to marvel at the size of the deck beams, carlings, and fore-and-afters, which would be considered heavy for a vessel twice the size of the Roosevelt, but when it is considered that at a critical moment, such as being squeezed from both sides at once, just at, above, or below the waterline, the life of the ship may depend upon the strength of one or perhaps two of these beams, their looks become unimportant, and crushing strength becomes the factor. It would seem that the designer had succeeded in providing a very strong deck structure. These beams are yellow pine, are moulded 16 in., and sided 12 in. at the center with a moulding of 10 in. and a siding of 12 in. at the ends. The 'tween deck beams are moulded 14 in. and sided 12 in. for the whole length and, to gain additional strength on this scantling, all beams are worked straight on the lower side. The main deck thick strakes are jogged down over these beams, and are also bolted down through the beams, and through the deck clamps, efficiently tying the beam ends.



BOILER OF THE PEARY ARCTIC EXPLORATION SHIP ROOSEVELT.

NOVEL STANCHIONS.

A somewhat novel feature, and one which will be watched with interest by the wooden shipbuilders of the country, is the stanchions between the beams and the main keel, which are worked as follows:

Between the top keelson and the 'tween deck beams, and 'tween deck and main deck beams, 3-in. wrought iron pipe stanchions are worked and held in place by 2-in. vertical wrought iron tie rods, which extend continuously from the top side of the main deck beam to the bottom side of the main keel and are set up at the main deck where the bolts are accessible at all times to take up any vertical play in the structure that may result from any slight working of the structure, due to the constant ramming into the solid ice.

On the under side of the main and 'tween deck beams, fore and aft continuous 6-in. channel bars are worked with continuous 9 x ⅜-in. fore and aft steel plates, worked on top of both upper and lower deck beams to prevent the wrought iron pipe stanchions from compressing into the wood beams, after the tie rods inside the stanchions are set up.

The plank sheer, water-way, and thick strakes for this vessel are of unusual strength throughout, and are of oak with the plank sheer moulded 14 in. and sided 10 in., water-way moulded 14 in. and sided 9 in., deck thick strake moulded 10 in. and sided 6 in. The top sides of these parts are held parallel to the waterline, as will be noted by reference to the midship section, but all are efficiently scarphed and bolted together.

There is no doubt that the great strength of these parts as indicated by the heavy scantling will be a very important factor when this vessel gets into troublesome quarters in the ice fields, as the occasion may arise when the ice may bank up on the sides in which event this heavy top side framing will play an important part.

GUARD STRAKES FOR LIFTING THE VESSEL.

The guard strake is of white oak, moulded 20 in. deep and sided 8 in. thick, and is fastened to the plank, sheer and through the frame. This fastening is worked with the idea of procuring as much vertical strength in the guard strakes as possible. On the outboard under side of the guard strake a 6 x 10 in. wrought iron band is spiked on, so that if necessity should arise where it is desired to free the vessel in a hurry, it is proposed to lay heavy plank on top of the ice immediately under these guard strakes and work hydraulic jacks at frequent intervals between this plank and the guard strake and thereby free the vessel.

Not only is this heavy construction carried out in the top side but all other parts are heavy in proportion. The deck hatch coamings are of white oak, and are fitted 30 in. high above the top of deck plank and bolted down through the fore and aft beams and fitted with heavy watertight tarpaulin hatch covers. The main deck plank is 3 in. by 4 in. wide, worked edged grained in lengths of from 30 to 40 ft. The scantling of this deck planking adds not a little to the fore and aft strength of the hull. The deck plank of the forecastle and margin strakes is the same size as for the main deck and fastened in a similar manner.

WATERTIGHT BULKHEADS.

Unlike the bulkheads fitted nowadays in modern vessels, the bulkheads fitted on the Roosevelt are of wood, of two courses of 3½-in. yellow pine, each worked diagonally to the other and stiffened athwartships by 9 x 6 in. yellow pine beams worked on each side against these two diagonal courses

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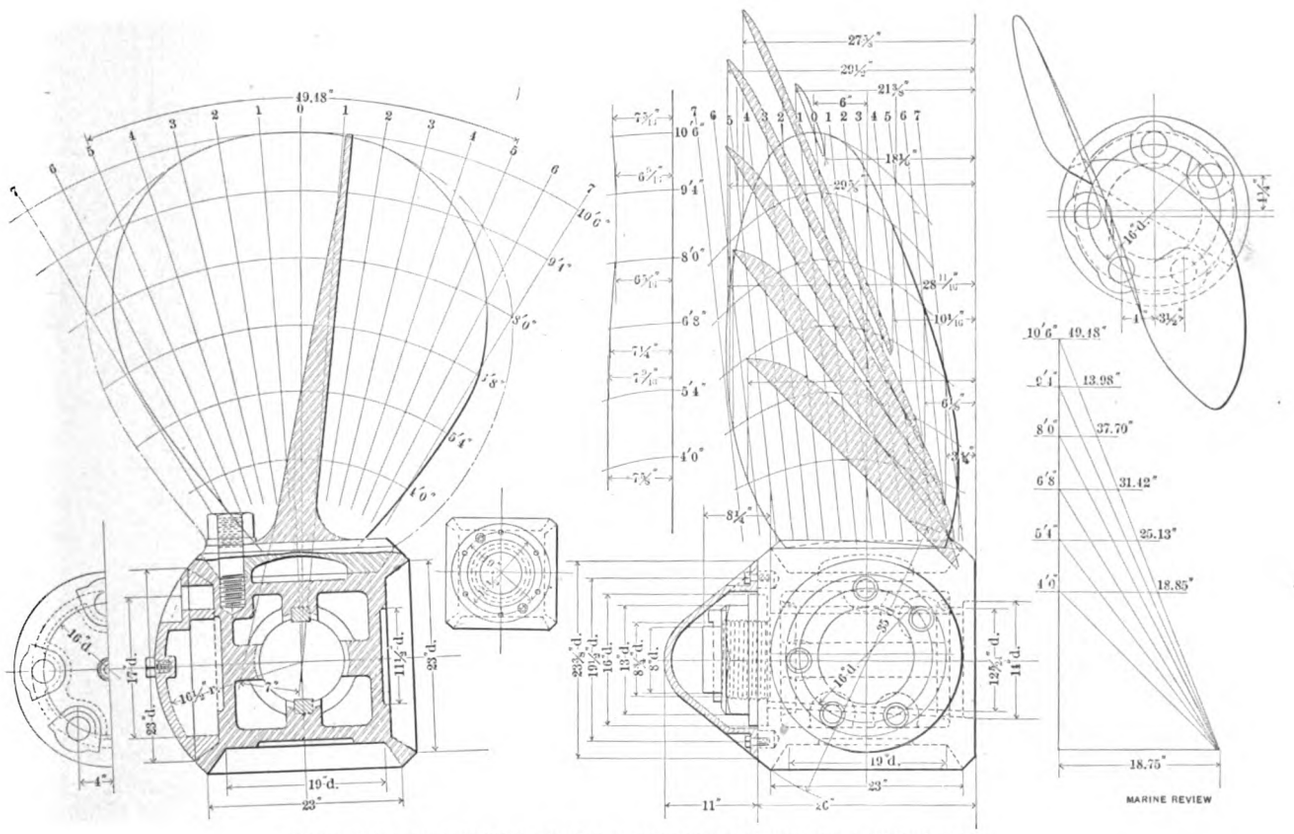
and bolted through and through. At the boundaries of the bulkheads inside of the ceiling, 6 x 8 in. wooden coamings are fitted all the way around and thoroughly calked and fastened on each side. Before the two courses of diagonal bulkhead planking was worked tarred canvas with a thick coating of red lead was worked between these courses.

Each bulkhead is fitted with small watertight doors right underneath the main deck beams so as to be able to pass coal and stores from one hold to the other without taking same into the open. The bulkhead between fire and engine rooms is made of steel owing to the heat in these places and is fitted with watertight doors for access between these spaces.

FOUNDATIONS.

The foundations for engine, boiler and auxiliaries, thrust bearings and other fittings are of steel channel, also of white oak, thoroughly fastened down through the timbers. As may be noted from the inboard profile, the propeller well and



PROPELLER FOR PEARY ARCTIC EXPLORATION STEAMER ROOSEVELT.

the rudder well of this vessel recalls to the wooden ship builder the days when propellers were unshipped and brought on deck, when it was desired to save coal and rely on sail power. These propeller and rudder wells are not for the purpose of saving coal, as much as to save the propeller after the vessel is frozen into the ice and to enable her to free herself after remaining for some months in a frozen condition. Experience has shown that to save the propeller, same will have to be removed and brought up on deck. As will be noted from the plans these propeller wells are watertight throughout and the shafting is so arranged that the propeller can be raised up and out without disturbing the tail shaft.

STEM AND STERN SHEATHING; ALSO WATER LINE BELT PROTECTION.

A slight resume of the waterline belt protection, also the bow and stern sheathing will probably be interesting to our readers. From a point about 10 ft. aft of the stem and one foot above the waterline is worked a belt plate of ⅜-in. steel plating on the sides and around the stern. This plating is snugly fitted over a thick layer of red lead fastened at the edges with flat head counter-sunk feathered spikes about 8 in. long. Through the body of the plates, similar spikes are worked about 9 in. apart each way. All these plates are double lapped, spiked with the after under-lapping the forward plates, about as indicated on the accompanying cuts of the midship section and sail plan.

Research of previous Arctic vessels fails to find any vessel with this sheathing carried all around the vessel. In most cases the sheathing is fitted at the bow and probably 30 or 40 ft. aft, but is not carried at the sides nor at the stern. It is believed, however, that it is an excellent idea to protect the planking from the continual pounding from a lateral and vertical direction underneath the counters.

Where the vessel will take the greatest pounding and probably receive the most indentations is at the stem and bows. This has been looked after to the extent that on both sides of the bow and stem for about ten feet aft of same and three above the waterline extending diagonally down and aft to a point about three feet aft of the fore-foot at both sides is worked one-inch steel plating. These plates are worked horizontally, fitting snugly against the vertical stem band and are riveted to the waterline sheathing referred to above, and fastened in a similar manner. At the skeg, below the propeller port, 1 in. steel plates are worked on the sides running fore and aft between the propeller and rudder posts and lapped on to the sides of these posts and are securely bolted through and through in a horizontal direction. These plates are worked as a protection against the starting of any of the butts in this vicinity.

APRON PLATES.

At the inboard side of the deadwoods, a ⅜-in. steel apron plate with flared flanges extending aft about 20 in. is worked to localize the shock due from the constant head-on pounding of the vessel into the ice. This apron plate is blunt, bolted to the deadwood and through bolted to the inside course of planking, is embedded in red lead and putty on the forward side and worked in one piece.

To take up any lateral diagonal working that may occur on

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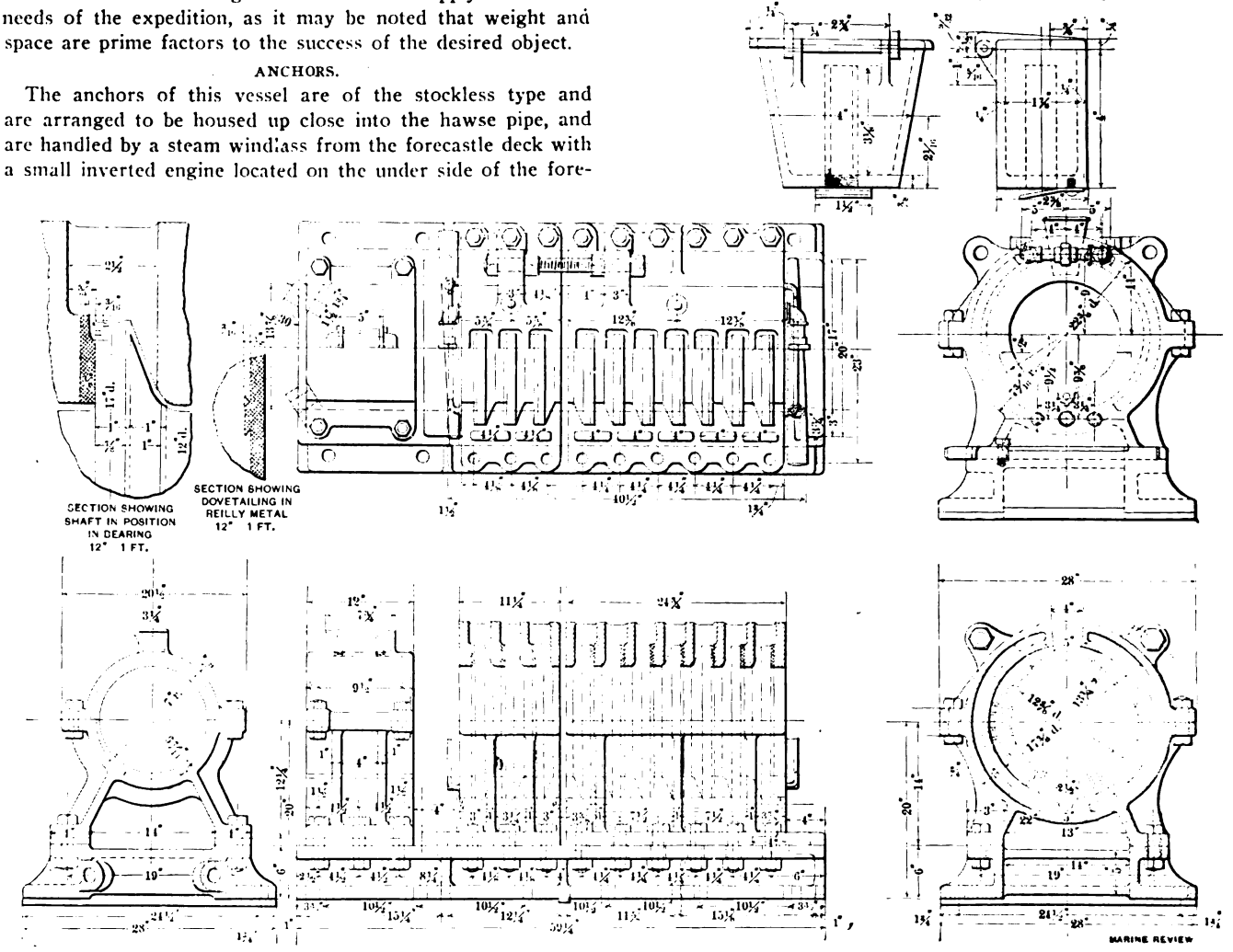
the top sides of the vessel, deck tie plates are worked fore and aft on each side of the cargo hatches, 18 in. wide by 15 pounds per square foot. These are riveted to diagonal deck straps of the same scantling.

The bridge, unlike that fitted to most vessels, is a portable structure, which will be used to navigate the vessel on the journey north and will be taken apart and stowed away when severe weather is encountered, so that same will be no impediment to the quick handling of the boats and other maneuvering after the heavy ice is encountered.

The usual number of fittings and outfit found in most steam vessels is lacking in the Roosevelt, only enough fittings, such as skylights, compass and other stands, running light boxes, and miscellaneous fittings are carried to supply the actual needs of the expedition, as it may be noted that weight and space are prime factors to the success of the desired object.

ANCHORS.

The anchors of this vessel are of the stockless type and are arranged to be housed up close into the hawse pipe, and are handled by a steam windlass from the forecastle deck with a small inverted engine located on the under side of the fore-



THRUST BEARING OF ENGINE FOR PEARY ARCTIC EXPLORATION STEAMER ROOSEVELT.

castle beams. The windlass is fitted with a vertical gypsy on the forecastle deck for moving ship, also with a vertical drum for handling the wire cable on the anchor. The necessary steam connections to this windlass are carried along from the boilers on the under side of the main deck. This windlass can be operated by hand or steam.

The steering gear of the vessel is a combination of hand and steam gear, arranged so that the vessel can be steered from four different points. In case of break-down at any one of these four points, relief tackle can be rigged up over the quadrant aft of the main deck. In view of the fact that the rudders are quite frequently carried away in the Arctic regions, the steering gear arrangements have received deliberate consideration for strength of parts.

MASTS AND SPARS.

The fore, main and mizzen masts are of single sticks of Oregon pine, the topmast and bowsprit are of yellow pine, the gaffs and spanker booms of spruce. The approximate sizes are as follows:

Foremast, about 82 ft. from top of keelson to topmast bend; length of pole, about 9 ft.; diameters at partners, about 19 in.

Mainmast, about 85 ft. from top of keelson to topmast cap; diameters at partners, about 20 in.

Mizzenmast, about 98 ft. from step to topmast bend; diameter of partners, 18 in.

Total length of main topmast, including housing length, 38 ft.; diameter of topmast about 7 in.

Length of fore, main and mizzenmast gaffs, about 25 ft.; diameter of gaffs, 7 in.

Length of spanker boom, 46 ft.; diameter, about 12 in.

Length of bowsprit, about 20 ft.; diameter, 15 in.

Provision is made at the main topmast head for raising and lowering the crow's nest for the lookout.

The fore and main masts step on to the keelsons, the mizzenmasts step on to a special foundation just aft of the engine. All three of these masts are arranged to be quickly unshipped in case of necessity.

VERY HEAVY RIGGING.

The rigging being fitted to this vessel is of galvanized wire rope almost throughout. The lower topmast rigging is served for the entire length. All the standing rigging is set up inside the bulwark with rigging screws, shrouds, stays and back stays, and laid down over the heads of the masts with eyes, and is of the following scantling:

Foremast shrouds, 3 in.; mizzenmast shrouds, 3 in.; mainmast shrouds, 3 in.; foremast back stays, 3 in.; mainmast and mizzenmast back stays, 3 in.; main and mizzen topmast back stays, 2¼ in.; spring stays, 3 in.; fore stay 3½ in.; jib stay,

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2½ in.; main topmast and mizzen topmast stays, 2¼ in.; main topmast shrouds, 1¾ in.; boat davit guys, 2 in.; smoke stack guys, 2 in.

The following are the sizes of the blocks being fitted for the Roosevelt:

Where used.	No.	Kind.	Size.	Mortise.	Strap.	Hook.	Remarks.
JIB							
Halliard	1	S	7 in.	1⅛ in.		Sister	Gin.
Halliard	1	S	7 "	1⅛ "		"	
Downhaul	1	S	6 "	1 "	1	Lashing eye	
Sheet pendants	2	S	7 "	1⅛ "			Clump
Sheet whip	2	S	7 "	1⅛ "	1	Sister	
FORE STAYSAIL							
Halliard	1	S	8 "	1¼ "		Sister	
Halliard	1	S	8 "	1¼ "	1	"	
Sheet pendant	2	S	8 "	1¼ "			Clump
Sheet whip	2	S	8 "	1¼ "	1	"	
Downhaul	1	S	7 "	1⅛ "	1	Lashing eye	
FORE TRYSAIL							
Peak halliards	5	S	9 "	1⅜ "	1	Shackle	
Throat halliards	2	D	9 "	1⅜ "	1	"	
Outhaul	1	S	7 "	1⅛ "			Clump
Outhaul whip	1	S	8 "	1¼ "	1	Sister	
Downhaul	1	S	7 "	1⅛ "	1	"	
Sheet pendant	2	S	8 "	1¼ "			Clump
Sheet whip	2	S	8 "	1¼ "	1	"	
Brails	6	S	6 "	1 "	1		
MAIN STAYSAIL							
Halliard	1	S	8 "	1¼ "		"	Gin.
Halliard	1	S	8 "	1¼ "		"	
Downhaul	1	S	7 "	1⅛ "	1	Lashing eye	
Sheet pendant	2	S	8 "	1¼ "			Clump
Sheet whip	2	S	8 "	1¼ "	1	Sister	
MAIN TRYSAIL							
Peak halliard	5	S	9 "	1⅜ "		Shackle	
Throat halliard	2	D	9 "	1⅜ "		Shackle	
Outhaul	1	S	7 "	1⅛ "			Clump
Outhaul whip	1	S	8 "	1¼ "	1	Sister	
Downhaul	1	S	7 "	1⅛ "		"	
Sheet pendant	2	S	8 "	1¼ "			Clump
Sheet whip	2	S	8 "	1¼ "	1	"	
Brails	6	S	6 "	1 "	1		
MIZZEN STAYSAIL							
Halliard	1	S	8 "	1¼ "		"	
Halliard	1	S	8 "	1¼ "	1	"	
Downhaul	1	S	7 "	1⅛ "	1	Lashing eye	
Sheet pendants	2	S	8 "	1¼ "			Clump
Sheet whip	2	S	8 "	1¼ "	1	Sister	
MIZZEN GAFF TOP SAIL							
Halliard	1	S	7 "	1⅛ "		Sister	
Halliard	1	S	7 "	1⅛ "	1	"	
Dawnhaul and clew rope	3	S	6 "	1 "	1		
SPANKER							
Head outhaul pendant	1	D	8 "	1¼ "	1	"	
Head outhaul whip	1	S	6 "	1 "			
Foot outhaul pendant	1	S	8 "	1¼ "			
Foot outhaul whip	1	S	8 "	1¼ "	1	Sister	
Topping lift	2	S	8 "	1⅜ "		Shackle	Gin.
Sheet	2	D	9 "	1⅜ "	1	"	
Sheet	2	S	9 "	1⅜ "	1	"	

RUNNING RIGGING.

All of the rigging is of the best quality Manila rope. All sizes above ⅜ in. are 4-strand; all boat and gangway falls are 4-strand. The principal sizes of the rigging are as follows:

Staysail sheet	2¼ inches
Jib sheet	2½ "
Falls, main and mizzen brails	2 in. Manila
Foremast and mizzen gaff halliards	3 in. Manila
Staysail, jib, and whips	3 in. "
Main and mizzen staysail whip pendants	2⅛ in. "
Spanker sheet	3¼ in. "
All jib falls	3½ in. "

Brails, clew lines and gaff vangs are in proportion, and the balance of the Manila rope for all rigging of the vessel is in proportion to the above. In connection with this rigging the following spare blocks are supplied.

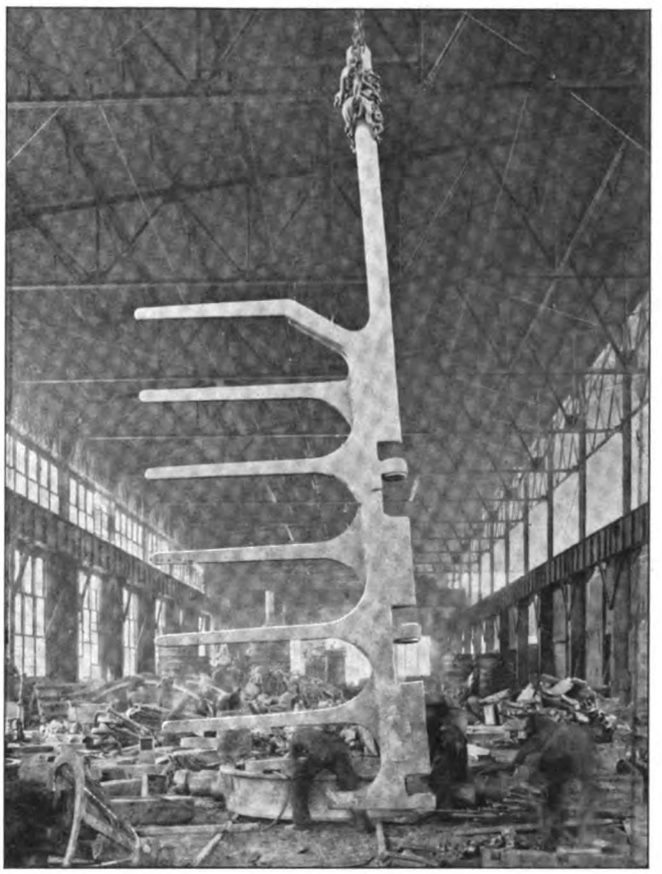
Where used.	No.	Kind.	Size.	Mortise.	Strap.	Hook.	Remarks.
Boat falls	16	D	10 in.	1½ in.	1		
Boat falls	8	D	9 "	1⅜ "	1		
Deck tackle	2	D	12 "	1⅝ "	1	Single	
Deck jigger	8	D	8 "	1¼ "	1		
Deck jigger	8	S	8 "	1¼ "	1		
Relieving tackle	4	D	9 "	1⅜ "	1	Single	
Snatch block	4	S	12 "				
Snatch block	4	S	10 "				
Snatch block	4	S	8 "				
Snatch block	4	S	7 "				

SAILS.

Jib, No. 5 canvas; staysail, No. 5 canvas; topsail, No. 5 canvas; foresail, No. 5 canvas; mainsail, No. 5 canvas; spanker, No. 5 canvas; main topmast staysail, No. 5 canvas; mizzentopmast staysail, No. 5 canvas; main topsail, No. 5 canvas; hatch canopies, No. 6 canvas; one set of awnings, No. 4 canvas; mizzen mast steering cover, No. 6 canvas; boat covers, No. 5 canvas; wheel and binnacle covers, No. 6 canvas.

DIFFICULT BIT OF CASTING

The National Foundry Co., New Haven, Conn., recently turned out two exceedingly fine castings for oil barges now under construction at the plant of the Fore River Ship Building Co., Quincy, Mass., and as will be seen from the photographs, they succeeded well in this delicate and difficult work. The castings are to be used as stern posts and though not of much weight, being only 2,900 lbs., are extremely long for that weight, being 17 ft. long and 6 ft. wide. The castings were readily accepted by the ship building company.



STERN POST OF AN OIL BARGE, 17 FT. LONG AND 6 FT. WIDE, CAST BY NATIONAL STEEL FOUNDRY CO., NEW HAVEN, CONN.

SUEZ CANAL TRAFFIC

The following is a return of the navigation through the Suez canal for four weeks ending March 23, 1905, compiled by Edward A. Willard & Co. of New York, showing the number of vessels coaled under the various flags and the amount of tonnage:

	Number of vessels.	Amount of tonnage.
Austrian	16	51,044
British	224	725,689
Danish	4	10,086
Dutch	16	40,336
French	22	73,112
German	59	184,026
Greek	2	2,760
Italian	9	18,917
Norwegian	8	11,448
Portuguese	1	7,506
Russian	6	13,891
Spanish	2	5,919
Swedish	1	267
Turkish	6	6,968
Total	376	1,151,969

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ICE BREAKER FOR THE DELAWARE

Especial interest attaches to the ice breaker which the Cramps will build for the city of Philadelphia for use on the Delaware for while it follows accepted design it also embodies some new features. This ship as at present designed has the following dimensions: Length over all, 232 ft. 4 in.; length on water line, 222 ft. 4 in.; breadth, molded, 45 ft.; depth, molded, 22 ft.; draught in fresh water, 13 ft.; displacement, 2,450 tons.

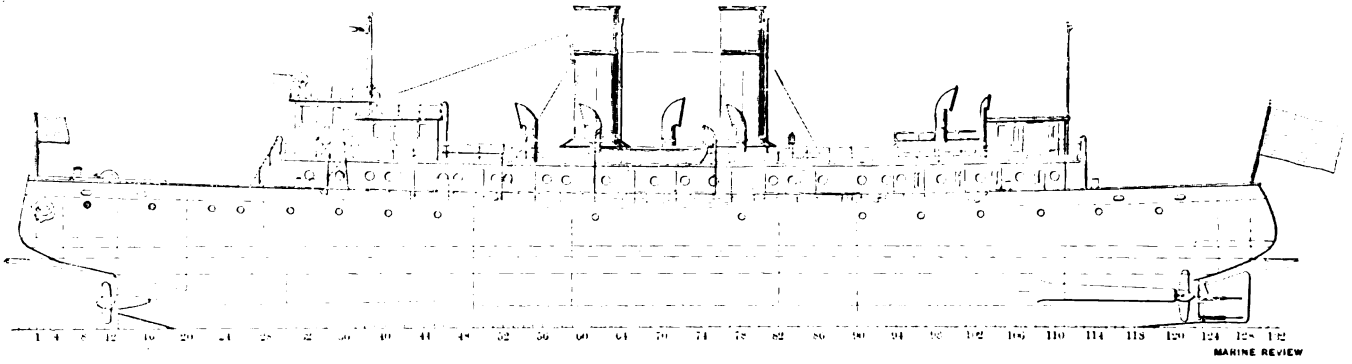
Her scantlings are very considerably above the highest requirements of the American Bureau of Shipping for ocean-going steamers. Her frames are 22 in. apart, except at the ends where they are spaced 15 in. forward and 18 in. aft, to give great strength. There is a double bottom and subdivision into ten main watertight compartments. This makes her practically unsinkable. There are two decks, one just above the water line, which has no camber or shear, thus presenting great rigidity against being crushed in by ice.

The ice belt is 6 ft. broad, laid perfectly smooth. This belt, and the keel, are ⅞ in. thick and additional stiffness is introduced in the plating near the bow. The bow and stern both meet the water at a sharp angle to be very effective in crushing the ice. The rudder is large and both it and the rudder stock are made exceedingly heavy. There is accommodation for fifty officers and men, all above the main deck.

The machinery consists of the following:

Three cylindrical return tube boilers, two double ended and one single ended, with a total grate surface of 337.5 sq. ft., supplying steam at 170 lbs. per square inch. Three triple expansion engines, 18, 28, and 44 in. diameter of cylinder by 36 in. stroke of specially heavy design. Two of these are placed astern driving twin screws of 10 ft. diameter. The other drives a screw in the bow of 8 ft. diameter. There are the usual auxiliaries in connection with the propelling machinery.

The bunkers have a capacity of 420 tons of coal which will give a supply for ten days of continuous work. Besides the auxiliaries to be used in connection with propulsion and the ordinary work of the ship, there are powerful installations both for wrecking and fire purposes. For wrecking a 10-in. ballast pump is fitted capable of dealing with 1,000 tons of water per hour. So that if any ship is nipped in the ice and leaking badly, the ice breaker can come alongside and keep her afloat while she takes her to a place of safety. This ballast pump also serves the large trimming tanks placed at the bow and stern. The fire pumps will consist of two sets of three cylinder pumps having a total capacity of 8,000 gallons per minute. These installations, though adding considerably to the first cost, will greatly broaden the usefulness of the ship. She will also have a complete electric light outfit and her powerful searchlight will allow her to go on working in the night.

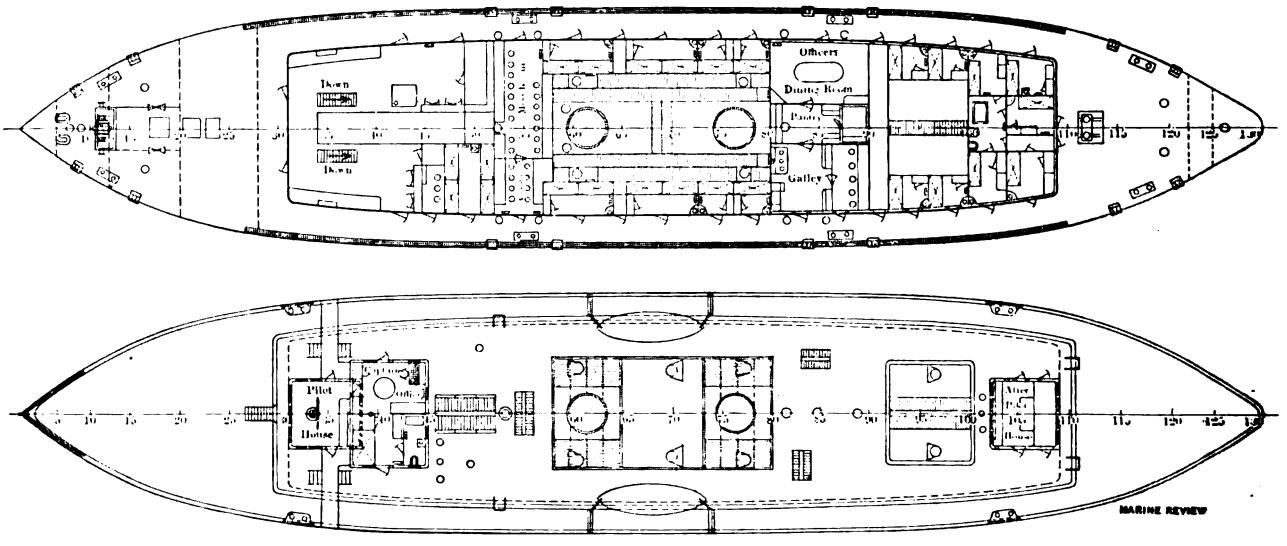


PROFILE OF THE DELAWARE ICE BREAKER.

It has been thought judicious to supply ample boiler power, so that even under the worst conditions she can still develop fully 3,000 H. P. and so do her full work. With good coal and good stokers it might be run up to 3,700 I. H. P., or even somewhat higher.

The greatest horse power will be required when working in practically clear water, the ship proceeding at full speed, which will be from 14 to 15 statute miles per hour. The horse power will be distributed as follows: After engines, 2,400 I. H. P.; forward engines, 400 I. H. P.; steam for heating ship, keeping pump sections clear of ice, etc., 240 I. H. P.; total, 3,040 I. H. P.

The after engines are here supposed to be working from 100 to 110 revolutions per minute; but with the fullest cut off and with the by passes open the power of the after engines



DECK PLAN OF THE DELAWARE ICE BREAKER.

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may readily be run up to 3,000. This, with a corresponding of power on the forward engine, would absorb all the steam the boilers could make.

In the condition supposed, that of practically clear water, the forward screw would only be required to clear itself, as the power for propulsion can more economically be applied astern. Also the steam required to keep the sections from being frozen is then very small, so that 240 I. H. P. should be ample for the purpose to which it is assigned. But in other circumstances this will be very different.

When the ship is running in comparatively heavy but clear ice, the increased resistance due to the ice will reduce the speed to, say, 6 miles, the revolutions of the after engines will be lowered and consequently also the amount of steam they require, but more is now required for other purposes. For by working the bow screw energetically a strong suction of the water from under the forward ice is obtained, and it has been found by experience, with all the ice breakers having a bow screw, that the ice is thus cracked ahead of the ship. This, indeed, is one of the strongest arguments in favor of the bow screw as by its use the speed of the ship is at least double when working in ice and, of course, the useful work it can do is increased in the same proportion. This great advantage is gained at the expense of very small additional first cost and the running expenses of a few hundred horse power. The power exerted by the bow screw could now, however, be judiciously raised to 600 or 800 I. H. P., to increase this action ahead of the ship, and the steam pipe for keeping the pump suctions clear will have to be brought into use. The previous experience with ice breakers, as given by various writers, seems, in each point, to bear out the present design.

The Finnish ice breaker, Sampo, a ship of practically the same length and breadth as this design, but of 18 ft. draught, with heavier work to do, has an ice belt in way of the water line of ¾ to ⅞ in. thick, against ⅞ in. in the present design. The frames, however, are spaced 18 in. As stated above, the frames in the present case are spaced 22 in., except at the ends, where they are 15 and 18 in. apart. The engine power of the Sampo is 2,500, the engines being capable of being forced to 3,000. In the case of the proposed boat, 3,000 can readily be attained without forcing and several hundred more on emergency.

The Lake Baikal ice breaker, built by Messrs. Armstrong, Whitworth & Co., who also built the Sampo, is 290 ft. over all by 53 ft. 6 in. broad on the waterline, by 18 ft. 6 in. mean draught. This is a larger ship than the Philadelphia and is built for much heavier work. In her the keel strake and two strakes near the water line forming the ice belt are 1 in. thick —⅛ in. thicker than the present—reinforced by 11 ft. wood backing in way of the water line. The frames are spaced 24 in., except at the ends, where they are 18 in. apart. In proportion of the work to be done the present design is decidedly stronger.

Precisely the same distribution of engine power is adopted in the Lake Baikal ship and the present designs, there being three sets of triple expansion engines, all of the same size, two placed aft and one forward. And, notwithstanding considerably greater size of the Lake Baikal ship and its heavier work, the total power of machinery is little greater than that for the Delaware. The following table shows the comparison:

	Lake Baikal.	Delaware.
Cylinder diameters, inches	19½, 31, 51	18, 28, 44
Stroke, inches	36	36
I. H. P. each engine	1,250	1,200
Steam pressure, pounds	160	170
Grate surface, sq. ft.	...	337.5
Heating surface, sq. ft.	12,400	10,200
Length, feet	290	222
Breadth, feet	53.5	45
Draught, mean feet	18.5	13

The Ermack is a much larger ship, being 305 ft. long, 71 ft. broad, and 42 ft. 6 in. deep. She has 10,000 I. H. P. in four engines of the same design, three of which are placed aft and one forward. Regarding the experience of the Sampo and Ermack, the following interesting quotation is given by Mr. Swan:

"Experience with the Sampo and Ermack has shown that pack ice of practically any thickness can be negotiated; and in the case of the latter vessel, she on one occasion encountered a pack which was measured and found to be of a total thickness of 34 ft., 9 ft. being above the level of the field, and through which she successfully forced her way, a feat which would have been quite impossible but for the action of the forward propeller.

"Experience with the Ermack has shown that she has broken composed ice of 8 ft. 3 in. in thickness, and she has gone through field ice of about 40 in., with 6 in. of snow upon it, at a speed of 2½ to 3½ knots; moreover, she has been driven at a speed of about 11 miles through clear ice of 24 in., whilst ice under 18 in. has little effect upon her. It is found that snow has a wonderfully great retarding influence upon an ice breaker, much more so than a similar thickness of solid ice."

This quotation seems to put not only the value but the absolute necessity of the forward propeller beyond any question. It also justifies the estimate given above that the proposed ship for the Delaware will be able to run at 6 knots speed through any ordinary clear ice to be met with in our river. If further evidence of the value of this propeller is required it may be found in a letter written to Mr. Runeberg by the commander of the Finnish ice breakers Sampo and Murtaja, the latter being of 1,200 I. H. P. and having no bow screw. The quotation is as follows:

"On Feb. 11 we went through a pack ice belt of 3.5 miles breadth and 5 ft. to 8 ft. thickness at a speed of about 2 knots in 1 hour 45 minutes without stopping. This work could not have been done by the Murtaja in less than 18 hours of continuous hard work, exhausting the engine room and stokehold attendants."

The only ice breaker recently built without a bow screw, so far as we have found, is the Montcalm, now at work on the St. Lawrence. An appreciative article in the Marine Review of Feb. 23 states that she is 245 ft. long between perpendiculars and 40 ft. 6 in. beam. She has twin screw engines of 3,600 I. H. P., capable of being raised to 4,500 with forced draught. While the writer speaks of her moving serenely on through ice floes up to 12 or 25 in. thick, she does not seem at all competent to deal with such ice as the Sampo and Ermack encountered, as noted in the quotation we have given. Instead we have what must rather be regarded as a record of partial failure. She does not attack an ice jam directly. To quote from the paper:

"Instead of running the steamer head on to the jam, which would hang her up on the ice, Capt. Koenig takes her in on an angle. Meeting the heavy obstruction the steamer sidles outward toward the open water but not before a considerable section of ice has been broken away. By repeated attacks of this kind, on the ebb tides, large bodies of this heavy ice are released and carried off. It would be quite possible for the Montcalm to break up the present jam at Cape Rouge within a month by the methods pursued, but it has been decided upon that the gain for the moment was not commensurate with the work required, but at the end of March the Montcalm may be confidently relied upon to free the river of all ice obstruction between Quebec and Montreal and give two weeks earlier navigation for all incoming and outgoing craft."

The Sampo or Ermack would have gone straight through this jam and cut it adrift. The credit of introducing the bow screw in ice breakers is due to Mr. Frank E. Kirby, the well-known American naval architect, who first applied it in the car ferry St. Ignace, plying at the straits of Mackinac, and subsequently on the St. Marie on the same station. The Delaware ice breaker was designed by the firm of Melville & MacAlpine with M. C. Furstenau as associate engineer.

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MAY 4, 1905.

Mr. W. B. Robinson, who during the past four years has made an enviable reputation for himself as marine editor of the Detroit Free Press, has been appointed to the position of associate editor of the Marine Review. Mr. Robinson's success is deserved since it is the reward of hard work. He made the roses bloom in the desert, as it were, for he conducted a marine department in the Free Press that was quoted from one end of the lakes to the other for its accuracy and intimate knowledge though Detroit is, in itself, not a center of marine activity. Mr. Robinson entered upon his new duties May 1.

It will be observed that the present issue of the Marine Review is devoted to topics that are likely to be of interest to the engineer. It is the purpose of the Marine Review to make its first issue in each month of especial interest to marine engineers and succeeding issues will be more complete than the present one. The modern steamer has grown to be an enormous machine shop below deck and is steadily becoming more so. The Review will, through its corps of correspondents endeavor to relate each month all that is interesting to engineers. It invites contributions from marine engineers everywhere. There are constantly occurring on board ship incidents of extreme interest to engineers. Many of these, of course, never see light because they are not related and are known only to those who happen to be present. The Review will endeavor to make it worth the engineer's while who communicates such incidents to it.

Marine machinery is undergoing at the present time a tremendous revolution and it is fitting that even a special number should be devoted each month to it.

The sensation of the past month in marine circles has been the exhibition trial on the Thames at Greenwich of a boat 40 ft. long, 5 ft. wide and 8 in. draught built by Yarrow & Co. and equipped with engines by Napier & Co. She is intended for racing purposes. There are two sets of gasoline engines each with four cylinders, 6½ in. diameters by 6 in. stroke, each set of engines driving a three-bladed propeller. The bottom of this vessel for nearly its whole length is perfectly flat. The result is that at high speed she skimmed over the top of the water and attained a speed of 26 knots, which is the fastest speed on record for a boat of such small dimensions. It is estimated by Messrs. Yarrow that a torpedo boat destroyer of 220 ft. in length fitted with gasoline engines would reach a speed of 45 knots per hour. The possibilities here are enormous.

American ship builders can well look with concern to the slipping away of work to foreign ship yards in these days when ship building for the foreign trade is nil. It is a hardship to lose the work, but a greater hardship to be informed by journal of the contemporary technical press that our builders cannot do this kind of work. Doubtless it is such representation of American inability to build sea-going dredgers which has been laid before the departments at Washington, so that they passed through three vessels and intended passing the fourth—into American waters, scot free of navigation laws, customs dues, and requirements for licensed officers. The monetary value of this lost ship building is not the bagatelle it might seem, and a million dollars' worth of ship construction placed outside of the United States should only be permitted in the case of the gravest national need, or when it can be shown that there is no law on the statute book to prevent it. Fortunately such laws exist, as was indicated by Dr. Frank Van Vleck in the issue of the Marine Review of March 9. In this number he further shows more of the nature of the construction of these vessels, and points out what the American ship builder has missed.

It is not only the present value of these seagoing dredgers which has escaped us, but the value of the future contracts which may soon escape us. The Marine Review while advocating the passage of the much needed new laws for the improvement of the American merchant marine, yet at the same time desires to assert its belief that the old laws applicable to navigation should be fully enforced, and if not promptly and effectively applied, the result may be as

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before indicated in this journal, the Panama canal commissioners may rush over to Europe with their contracts for vessels and for dredgers. Furthermore they may claim a certain amount of precedence for so doing, by virtue of the Galveston exemptions. It is of course an anomalous condition that private parties should urge the government to do its whole duty, but we know that the government has erred doubtless due to the very rarity of the offense. When the matter is carefully and consistently agitated, it is also as well known that the departments concerned will each of them put into force and effect the regulations already provided for the cases.

We believe that the government is always on the side of the American ship. Although there have been at times some strange lapses, as when a year or two since, the Philippine Commission of Insular Administration let contracts in Hong Kong, Shanghai and Nagasaki for the construction of about one million dollars worth of vessels for the Insular navy, termed the Bureau of Coast Guard and Transportation, without so much as even inviting tenders from Americans —of course this was an economical course, for the Island government—but was it patriotic?

The ethical question as to whether the government should buy in the cheapest market, American or foreign, has always been decided by congress that a duty to the people obligates purchase from Americans solely; otherwise today we should perhaps be purchasing our battleships from England or Germany and our armor from Krupps.

GREAT LAKES MISCELLANY

The Bertram Engine Works Co., Toronto, Ont., has just finished replacing the port cylinder and a new frame in the steamer Chicora of the Niagara Navigation Co.'s fleet. The engines were tested under steam by Mr. J. J. Weinert, the mechanical engineer at the yard and everything was satisfactory. The steamer Spartan of the Richelieu & Ontario Line was lengthened 25 ft. at the yard and is now having the finishing touches put upon her. The new dipper dredge now under construction at Bertram's is having her machinery installed. The company is fitting her with all the latest appliances, such as copper pipes, surface condensers, fresh water tanks and steam capstan. She is intended to be used in salt water on the coast to the maritime provinces. The all-steel tug for ice breaking on Lake Superior is fast reaching completion.

At the annual meeting of the stockholders of the Joseph Dixon Crucible Co. the old board, consisting of Edward F. C. Young, John A. Walker, Edward L. Young, William Murray, George T. Smith, Joseph D. Bedle and George E. Long, was unanimously re-elected. The board of directors re-elected the former officers, namely, Edw. F. C. Young, president; John A. Walker, vice-president and treasurer; George E. Long, secretary. Judge Joseph D. Bedle was also re-elected as counsel. The stockholders present expressed themselves as thoroughly satisfied with the management of the company by its officers. Of the total number, 7,345 shares, there were represented 7,145 shares.

President William Livingstone of the Lake Carriers' Association has arranged for a double system of markers on both sides of the channel at the Lime Kiln crossing, to do away with the danger brought about by vessels sagging against the single floats and carrying them away. A spar buoy will be placed at the side of the present lantern floats. An anchorage above the signal station at Elliott's point will also be marked in order that up-bound vessels waiting for rising water over the crossing may find deep water to the eastward of the deep channel, and still be within sight of the new water signals installed by the Lake Carriers' Association.

While coming through the ice fields in Whitefish bay this week, the whaleback barge No. 134 crashed into the steamer Lafayette, punching a hole in the steamer's stern above the water line. This is the second accident of the same kind that has happened to vessels of the Pittsburg Steamship Co. this week. On Monday the steamer Douglass Houghton ran into an ice floe near Parisian Island. The steamer was brought to a standstill by the impact and her consort, the Sydney G. Thomas, ran into her.

A special meeting of the executive committee of the board of supervising inspectors of steam vessels will be held at Washington July 1, to consider a revision in the rules and make a distinction between vessels carrying passengers for hire and those carrying passengers as guests only. Owners of freight vessels on the lakes do not like the idea of having their vessels classed as passenger boats and provide passenger equipments for their guests during the summer season.

The steamer Byron Whittaker put into Escanaba this week with 6 ft. of water in her hold and with a hole stove in her bow below the waterline. It is supposed that she struck an obstruction while passing between Squaw and Garden islands. The hole was temporarily stopped and the Whittaker left for Chicago for repairs.

An important deal was made in iron circles last week whereby the Lackawanna Steel Co. took possession of the Brotherton and Sunday Lake mines of the Gogebic range. Jones & Laughlins of Pittsburg have purchased the Leetonia mine on the Mesabi range. The deals were negotiated by Joseph Sellwood of Duluth.

The bow of the barge Thomas collided with the stern of the steamer Douglass Houghton off Parisian island Monday while the steamer was fast in the ice. Neither boat is leaking although both were considerably damaged.

Sidney Bickford, for several years agent for the Algoma Steamship Co., at Detroit, has resigned to become traveling freight and passenger agent for the Northern Navigation Co. His headquarters will be at Toledo.

The Craig Ship Building Co. of Toledo has chartered the steamer Portage to Lake Superior parties. She will be used in the lumber trade between Saginaw and Lake Superior ports.

The first cargo of anthracite coal to reach Chicago during the present season was carried in the steamer E. M. Peck and was consigned to Coxe Bros. Co.

Runnels & Sinclair, of Port Huron, have sold the steamers Maggie Duncan and O. O. Carpenter to W. Brigham, of Boston.

The Kelley Island Lime & Transport Co. has sold the steamer Isabella J. Boyce to Capt. John Pringle of St. Clair.

The steamer Wotan of the Louis Sands Lumber Co.'s fleet, was the first lumber boat to reach Tonawanda this year.

The Great Lakes Towing Co. has sold the tug Erie to L. P. & J. A. Smith of Cleveland, dredging contractors.

Capt. August T. Nelson of Milwaukee has taken out a patent on an electric steering apparatus.

The new steel ferry boat which is being built by the Pusey & Jones Co., Wilmington, Del., for the Newport & Providence Railroad Co., will be named Bristol. The Bristol will be a double ender with rudder and pilot-house at either end and will be propelled by paddle wheels. Her hull is of steel 212 ft. long.

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REPAIRING A PROPELLER SHAFT

The following account of the repairs executed at sea to the tail shaft of the steamship Milton are of interest to engineers. They were communicated to the Engineer of London by a correspondent. The accompanying engravings show the nature of the repairs. Fig. 2 shows the fracture very clearly and the section of the six keyways cut in each end by the engineers under the conditions described below. Fig. 1 shows the shaft on deck, with one clamp and the keys in position; the two other clamps being removed to show the keys clearly. While the repairs were being carried out the weather is described in the log as terrific on many days, and the ship in

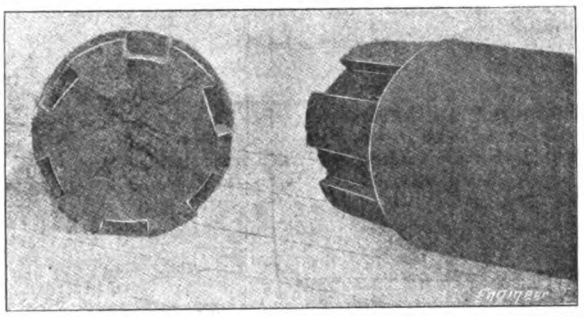

FIG. 1—THE FRACTURED ENDS OF THE SHAFT.

latitude 37 deg. south, longitude 66 deg. 55 min. east. The shaft is 13½ in. in diameter over the liner, and the tube is 20 in. external diameter, and about 2 in. thick all around. The accident occurred on November 17, 1904, at 9 p. m., in latitude 35 deg. 34 min. south, longitude 51 deg. 50 min. east, the ship at the time being 1,600 miles from Capetown, and on a voyage from Capetown to Bunbury, Australia. During the night the after peak tank was pumped out, and in the morning an examination was made of the stern tube, which was found intact.

The day was taken to consider the best means of effecting such repairs as would carry the ship to the nearest port, and on the morning of the 19th a start was made by drilling small holes at intervals along the top of the tube and inserting small wires to discover the position of the fracture, which was found to be between 4 ft. and 5 ft. from the propeller, and 2 ft. 6 in. inside the stern post. Next, a piece 2 ft. long by 6 in. wide was cut out of the top of the tube to examine the fracture. While this was being done all the after ballast tanks were pumped out, the fore peak filled with water, and ropes were passed over the propeller blades and round the nut to draw the broken ends of the shaft together, as the propeller had worked back against the rudder post. Spun yarn had also been wound round the shaft between the propeller and stern post, a work of some difficulty, as no one could remain on the propeller on account of the sea, so a plank was passed through the arch, a man got on each end, spun yarn was lowered down on one side with a weight attached and hauled up in the opposite side with a long hook, and by these means the tube was made so tight that an inch hole, drilled in the bottom of the tube, carried off the leakage. When the piece was cut out of the top of the tube, the fracture was found to be at the fore end of the stern bush and nearly square across the shaft. An attempt was made to draw the broken ends together, but they could not be got closer than 1⅛ in. of each other, so it was thought that the broken edge of the liner had lifted on the under side and was jammed on the collar of the stern bush. It was also seen that a good repair could not be made unless the shaft could be got closer together and a piece cut out of the tube right round.

The work of removing this piece was started at once and proved a difficult job owing to the limited space for working in, there being little over 3 in. space between the tube and the ship's sides at the after end. Holes were drilled round the fore end along the bottom, across the top and bottom of after end, and down each side from the top, and as each hole along the bottom and some distance up each side was finished, a wooden plug was driven in to keep back the leakage through the end of the tube, and to send it on to the hole drilled on the forward end to carry it away. When all that was possible had been drilled away, the plugs were drawn, the holes knocked into each other, and the two pieces burst off with steel wedges.

A clear view of the shaft was now obtained, and it was found that a piece of metal broken out of the shaft was jammed into the bottom, preventing the ends coming together. This was taken out and the broken ends drawn within ¼ in. of each other. It was decided to sink six fish-keys, 1 ft. long, 3 in. broad at the ends, 2¾ in. at the middle, and 1¾ in. thick, into the shaft, and over these to put three strong clamps. To make the keys stanchions were taken out of the 'tween decks, heated in the main boiler furnace and forged to shape, the bottom side faced up in a small lathe, and the sides made square with the bottom, the top being left rough as it came from the hammer. For clamps, derrick bands were taken and set to suit for two, three half-bands making a full clamp, and ¼ in. was allowed at the joints for draw. A heavier clamp was made out of another stanchion to come immediately over the fracture. The lighter clamps were secured with 1⅜-in. bolts and the heavier with 1½-in. bolts. A ⅞-in. steel countersunk tapped bolt was also fitted in the ends of each key so as to secure it to the shaft. A departure had to be made from the original plan. It was impossible to hold the shaft firmly enough to make a fine fit of the fish-keys owing to the pitching and rolling of the ship, so two parallel keys were made, the beds sunk to gauge, and the keys driven into them. This overcame the difficulty, and the remaining keys were fitted as originally intended. The work took twenty-five days to accomplish, and was carried

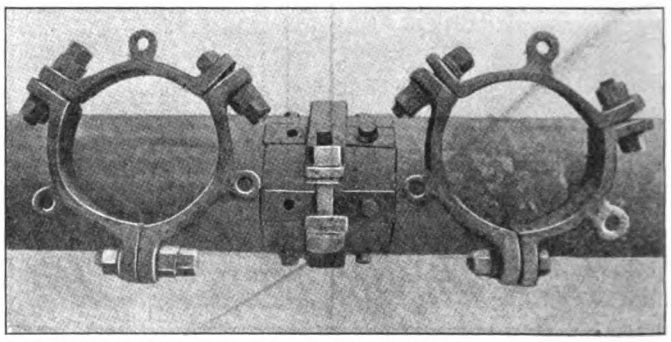

FIG. 2—THE REPAIRED SHAFT.

on day and night, only one man being able to work at a time, the space being so limited. It was also carried on under great difficulty and discomfort. Heavy weather was the rule, and the spun yarn wound round the shaft soon wasted away, leaving the engineers only such protection from the water as they could get by winding spun yarn and canvas around the shaft in the tank; but this gave way every time the ship dipped her stern deep in the sea. Three times they were driven out altogether and had to wait for better weather.

With the shaft repaired in this way the ship was able to steam to Mauritius, a distance of 1,184 miles at a speed of 4 knots, and at the survey held after arrival, the keys, clamps, etc., were found to be none the worse for the work they had done. All praise is due to the engineers for the way in which they undertook and carried through, under such adverse circumstances, an exceedingly difficult piece of work

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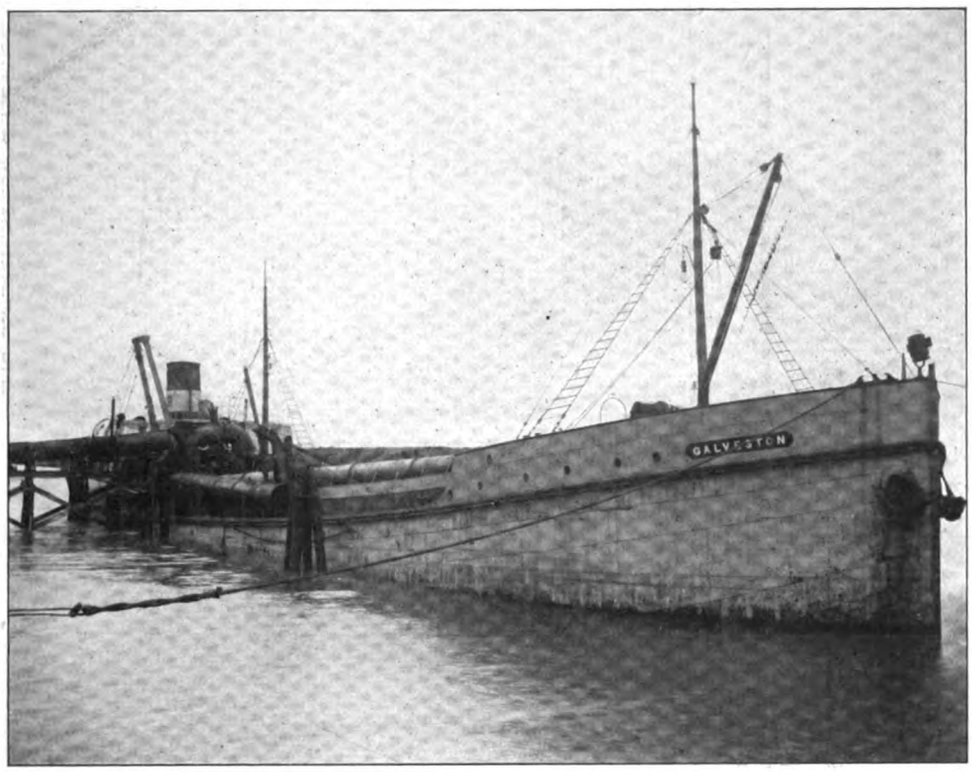
CAN AMERICANS BUILD DREDGERS?

Frank Van Vleck, Ph. D.

In these latter days of American shipbuilding when every true patriot stands amazed to find that not a single dollar is being spent in American shipyards for vessels of the foreign trade, it therefore behooves the ship builders to be astir to see that no further work slips outward to foreign yards, while the generous laws provided by the earlier framers of the constitution are still in existence.

That this work should go abroad, and through the efforts of our own friends, make the problem more difficult to prevent. But when these same friends, in their desire to take advantages of the lowest prices current in foreign yards, then turn, and apply the opprobrious term "American inability to build this class of vessel" then should every American shipbuilder arise, and demand the facts—for it is not and never may be the fact that we cannot build successfully any class of floating property, and this whether it be the mightiest battleship or the tiniest launch.



THE SEA-GOING DREDGE GALVESTON.

A recent prominent engineering journal of New York uses these most remarkable phrases—words which will indeed be news to the builders of the large and successful dredgers which have beeen turned out of many of the Atlantic yards. In describing the work of these foreign built sea-going dredgers now at work in an American port, it states:

"No attempt was made to have them built in this country, as no shipbuilding company here had built or could guarantee such craft. As the methods used in their construction were unknown in American yards, the risk of bringing them from Europe had to be assumed."

This certainly is important news to learn from an American technical journal, but it is not true that we cannot build these vessels even although it is the fact that these contracts went abroad.

Ordinarily this matter of the purchase of a few small vessels, in a foreign yard should give no concern to the busy American shipbuilder. But it now appears that these contracts placed in Europe aggregate perhaps a million dollars. When other work is scarce or non-existent, should our shipbuilders be asked to likewise bear this sacrifice? Especially in view of the fact that recently a number of large and successful sea-going dredgers have been built by Atlantic yards. To the naval architect or the dredger engineer who carefully looks over these, there will be found many points of superiority over the foreign designs. Of the sea-worthy qualities of the American construction none can question, nor will they be likely to fall to pieces from inadequate strength and defective riveting, as did one of these foreign-built vessels even before she was clear of European waters. If any one has doubts of what Americans can do as dredge builders, let him go on board one of the recently completed United States army dredgers, as the Benyuard, or even on one of the smaller ones. On all sides will be found the very best evidences of thorough workmanship, as well as a splendid routine of administration. After such an examination, to be then told, "that the methods used in their construction were unknown in American yards" should excite pity for the American who could, in the face of the facts, make such a misrepresentation of the American builders.

The details of these foreign dredgers already built and most of them delivered may not be uninteresting. There are four sea-going dredgers in the group, three of which are of large capacity. The smallest one is about 160 ft. long, with a beam of 28 ft., with a hopper capacity of 500 cubic yards, and is filled with a 22-in. centrifugal pump, and emptied by a similarly arranged centrifugal pump. The other three boats have each a capacity of nearly three times that of the smallest vessel mentioned. Their pumps are so designed, however, that by an original method of controlling the flow of material and water in the hold, one pump can serve both to fill and discharge the load. One of these vessels was built in Holland and the other in Dantzig, Germany, and all of them were started to this country under their own steam, one of which, as before recounted (*Marine Review,* March 9, 1905), owing to defective construction foundered at sea. The smallest of these vessels, the Holm, has been in operation at Galveston for some time, and one of the larger vessels has been put into service, while the remaining one will be started in use at an early date. It is stated that the fourth vessel which was lost will have another sent to replace it.

The construction of these sea-going vessels differs widely from the usual types of vessels for ocean work, owing to the fact that their engines, boilers and coal bunkers are placed far aft, in order to afford maximum space for the dredger hoppers. In this respect they much resemble the approved type of cargo carrier for the Great Lakes. All these dredgers were built with hinged double bottom hoppers, in order that the dredging spoil may be conveniently dropped after the vessel has steamed into deep water at sea.

All can sympathize with the people at Galveston, in their laudable efforts to re-create their city after the disasters of the flood, and can admire the boldness of the engineering undertaking which proposes to raise the entire grade of the city some six or seven feet by the dredgings taken from the

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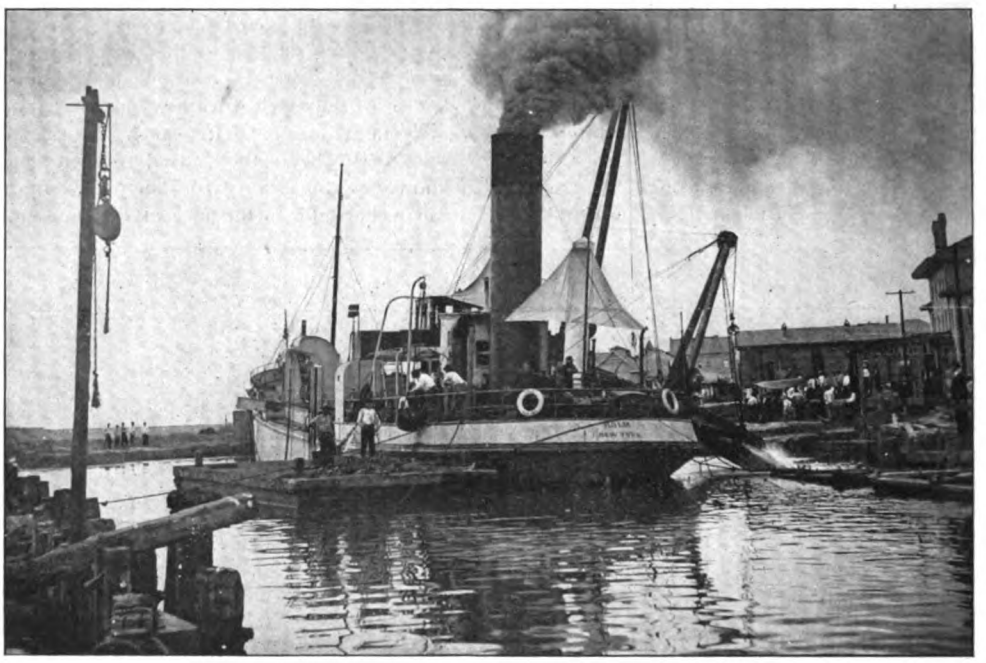
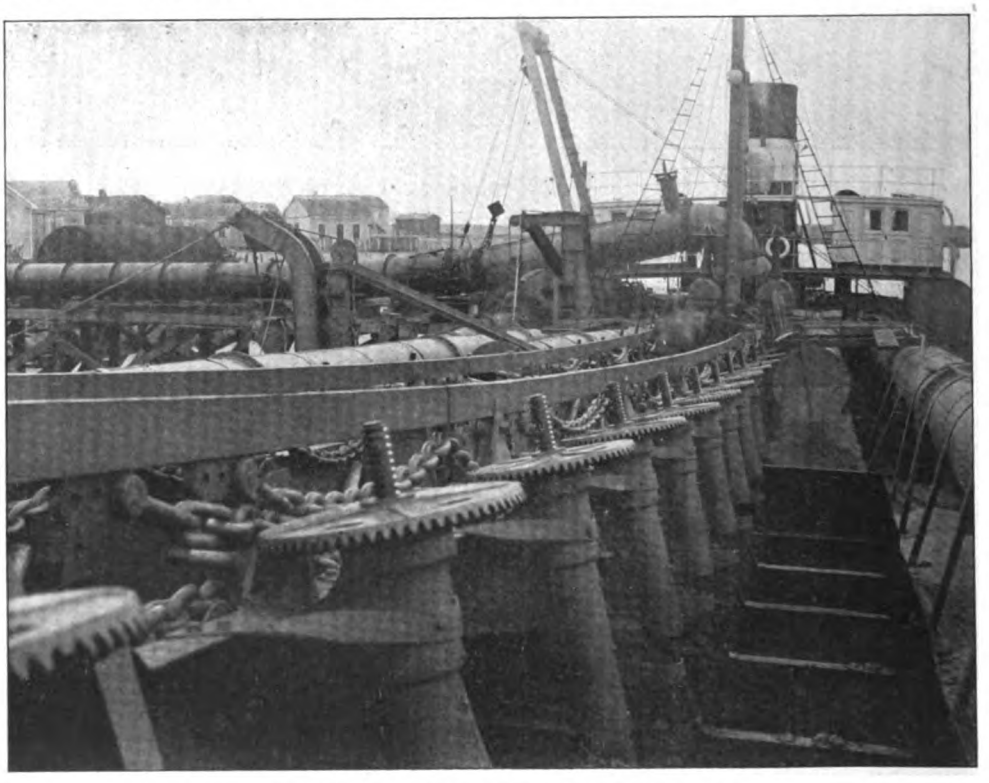
bay. The city should be encouraged also to obtain this work contracted for at the very lowest price, but in obtaining low bids for dredging, it is hardly to be inferred that the contractors figured so closely that they were obliged to use foreign vessels and foreign workmen. In fact, were not their figures based on American men and machines? Is not the profit of the use of foreign vessels and complement more likely to go into the contractor's own profit account rather than into reductions to be of benefit to the city?



THE HOLM, SMALLEST OF THE DREDGES.

AT THE HEAD OF THE LAKES

Duluth, May 3.—The head of the lake harbors have not been crowded with ships this week, though there have been a good many arrivals and there has been fear that the rush of ships after the raising of the ice blockade would be too much for the facilities of the docks. There has been no delay anywhere, indeed the ore docks have not been especially busy. But coal docks have been made to move lively to keep up to the satisfaction of vessel masters. It is a rather remarkable fact that the early arrivals were largely coal laden, and there was a slight congestion of vessels at these docks. But with the coming of this week things have become about normal.



THE SEA-GOING GALVESTON, BUILT IN EUROPE.
View showing detail of hopper controlling mechanism, and indicating that these large vessels are no lightly constructed specimens of naval architecture.

Very little merchandise has yet come up, most of the package freighters having been delayed. Some of them are getting into the grain market with the result that wheat freights have been reduced to 2 cents a bushel. A good deal of wheat went out last week and the amount in store was reduced about 1,250,000 bu. for the week. Flax and oats were slightly increased, for there seemed no especial demand for the shipment of either of them. Oats are selling for a lower price than when most of that now in store here was bought and it is liable to remain in stock until it commands a better figure.

May 1 grain deliveries on the Duluth board of trade amounted to about 500,000 bu. wheat and the same amount of flaxseed, the former chiefly to the firm of A. D. Thomson & Co., shippers, and the latter to the American Linseed Co. This stuff will probably go forward, the wheat anyway. The American Linseed Co. is understood to own about all the seed at the head of the lake, about $10,000,000 worth, and is in no hurry about either shipping or otherwise disposing of it.

There have been two shipments of wheat to Chicago the past week, in all 185,000 bu., and the last was sent on account of a legitimate milling demand, not to crush any corner, as was the first. These are all the wheat cargoes sent from here to that city, though reports from Chicago would indicate that scores of loads were going there from here. It doesn't take much real wheat to make the Chicago wind grain speculators run to hide.

Ore receipts at head of the lake docks are now running

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about 45,000 tons a day at the Duluth, Missabe & Northern road, 35,000 to 40,000 tons at the Duluth & Iron Range and 25,000 tons at the Great Northern. None of the roads has reached its regular business yet, though their summer schedules of ore trains are on. The mines are all shipping and steam shovels are busy everywhere, on all ranges. The receipts at Ashland are large and Marquette and Escanaba are both very busy. In most cases the troubles arising from recent strikes around Hibbing, Minn., are over, but none of the underground mines that were closed by the strikers have resumed and none of them are liable to do so for a while, remaining as a warning and lesson to the strikers. The striking fact about such an object lesson is that the underground mines pay perhaps 50 cents a ton more to labor for every ton they mine than do the surface ones, and their closing down and remaining still marks a sharp reduction in the demands for high priced and skilled mining labor. But the strikers forced them to close, and can have nothing to say.

It will be some time before concrete work on the south pier of the Superior entry can be resumed, and it will go on much more slowly than a year ago, for it is now far out beyond any protection of the harbor or old works and time must be chosen when there is no danger of winds and storms that will break the operations while the block is being set and is hardening. The blocks for this outer work will be much larger than any that have been laid and they will require some time to place and set. It will be two years before the entire pier is completed, though more than half its lineal dimensions was done last season.

The wreckage of the Portage lake bridge has been cleared away and vessels can now make the passage through the canal. They must still take the south draw channel, however, for the sunken scow still remains in the north channel. This is now being moved out. It will be some time, probably two or three months, before a new draw span has been erected and is running. In the meantime the copper mines north of Portage lake are working under some disadvantages. These mines, and those in their vicinity south of the entry, are steadily increasing their output and are now making copper at the rate of about 220,000,000 lbs. per year, far above any previous record. The fear of a general strike through the district that seemed prevalent a few weeks ago has worn off and there is now no likelihood of any serious labor trouble there during the summer. Copper is all going forward by lake, and the mines are keeping their docks clear, having sold far ahead into the summer, most of them till early fall months.

Steamships Mariposa and M. C. Smith, damaged in the ice on their way up the lakes are in dry docks of the Superior Ship Building Co., the former to come out in a day or two, the latter in about a week. All other vessels at the yards of that company for overhauling as a result of trouble with ice are out and away. Most of them had merely new blades in their wheels.

CHICAGO GRAIN REPORT

Chicago, May 2.—While shipments of the week total favorably against a year ago the immediate cargo situation is practically bare of shipping inquiry. Vessels offering freely at basis 1 cent per bushel Buffalo and Georgian Bay corn with slow cargo responses.

The local market is beset by a combination of slow conditions, though quite largely this depression is due to natural difficulties connecting the general distribution of lake carriers. It would seem therefore to be but a temporary activity and opinion is pretty well centered that with the regulating of stocks at this and neighboring ports, all vessels will shortly find profitable occupation. For the moment light grain receipts are favorable to fairly high market prices in wheat and corn, despite that the eastern cash inquiry is not in accord. Explanation of the latter point may be in that corn shipments eastward since Jan. 1, 1905, encouraged by the unusually low all rail carrying charges up to April 1 exceed by 12,000,000 bu. the quantity of last year, but doubtless new purchases will be in order very shortly. Comparative report of shipments and stocks as follows:

LAKE AND RAIL SHIPMENTS.

	This week.	Last week.	Same week last year.
Wheat	72,281	125,898	176,172
Corn	1,658,288	2,459,206	561,388
Oats	902,522	753,344	664,703
Rye	10,267	30,425	4,318
Barley	147,719	36,674	61,666
	2,881,077	3,405,547	1,468,247

	Shipments since Jan. 1, 1905.	Same time last year.
Wheat	3,870,331	4,033,242
Corn	26,970,200	14,818,046
Oats	15,696,000	16,520,385
Rye	497,000	627,400
Barley	1,919,276	2,213,295
	48,952,807	38,212,368

STOCKS OF GRAIN IN ELEVATORS.

	This week.	Last week.	Same week last year.
Wheat	4,410,000	3,957,000	4,639,000
Corn	6,207,000	7,272,000	8,925,000
Oats	5,397,000	5,553,000	4,037,000
Rye	141,000	172,000	419,000
Barley	60,714	63,000	381,000
	16,215,714	17,017,000	18,401,000

RIVER NOTES

On Monday and Tuesday, May 8 and 9, the members of the congressional rivers and harbors committee will be entertained at Pittsburg, and on Wednesday morning will leave on the steamer Queen City on their tour of inspection down the Ohio river to Cairo, Ill. While in Pittsburg, the members of the committee will be lavishly entertained, a large fund having been raised for this purpose. The program as at present outlined provides for a visit to the Homestead and Duquesne steel works and to the plant of the Westinghouse Electric & Mfg. Co. It also includes a trip up the Monongahela river where the tremendous industries that line both shores of this river will be pointed out. The Pittsburg entertainment will close with a banquet and early on Wednesday morning the trip down the Ohio will follow.

C. Jutte & Co., Pittsburg, have purchased Towhead island, opposite Louisville in the Ohio river and contemplate extensive improvements for the harboring of coal fleets and empty craft. The island contains about 100 acres and the company will not get full possession until April next year. The island lies between Louisville and Jeffersonville, Ind., and on account of its location has been a good harboring place for river craft. Large fleets of empty barges were kept in the back channel of the river formed by this island last winter by the Jutte interests and were safe from damage. It is the intention to deepen the back channel so as to provide a good harbor for coal fleets and other improvements are in contemplation which will make this island one of the best harbors in the lower Ohio.

Major William L. Sibert, United States engineer in charge of the improvements on the Allegheny, Monongahela and upper Ohio rivers and located at Pittsburg, has been notified by the chief of the United States engineers that the bids for work to be done on these rivers which he recommended have been approved. Work on the various contracts will be commenced immediately. The contracts awarded are as follows: Completing dam No. 2, Allegheny river, James H. McQuaide, contractor, contract price $197,337.08; dam No. 5, Ohio river, Dravo Construction Co., contractor, contract price $273,408; dam No. 4, Ohio river, Baker Contract Co., contract price $225,044.12.

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AROUND THE GREAT LAKES

The steamer Orinoco was released from Bar Point after lightering part of her cargo of coal.

The Standard Contracting Co. has been awarded a contract for raising the sunken tug Rocket at Lorain.

The new Canadian revenue cutter Vigilant is at the plant of the Detroit Ship Building Co. receiving minor repairs.

It is understood that the Kanawha Fuel Co. of Milwaukee will make extensive improvements on its docks at that port.

The Great Lakes Towing Co. has chartered the tug Byers to the Detroit Dredging Co. as a tender to the dredge at Bar Point.

The regular passenger season between Detroit and Buffalo was opened last week by the arrival of the Eastern States from Detroit.

The Lehigh Valley steamer Bethlehem which was in collision with the steamer Saturn in St. Clair river last week will be repaired at Buffalo.

Navigation at Port Arthur was opened last week by the steamer Newmount which broke through the ice and was followed by six other steamers.

The steamer Appomattox which was ashore at Windmill Point was released after 100 tons of her cargo had been jettisoned. She will go into dry dock.

The Tomlinson steamer Hoover & Mason will be launched at the yard of the Great Lakes Engineering Works, Detroit, Mich., on Saturday next.

The steamer H. M. Pellatt of the Montreal & Lake Superior line was the first boat to leave Montreal for Lake Superior this season. She sailed on Wednesday.

The steamer Mariposa which was in a collision with the Admiral above the Sault has gone into dry dock at West Superior. Several plates amidship will have to be removed.

The passenger steamer Turbinia saw the steamer Navajo disabled sixty miles from Kingston, having blown out a cylinder head. The tug Frontenac was sent out to tow her into Kingston.

A steel lighter 110 ft. long was launched at the Empire Ship Building Co.'s yard, Buffalo, last week for the Mutual Transit Co. The lighter is to be used by the Mutual Line in Duluth.

To meet the requirements of the steamer Wolvin and the other vessels of her dimensions, the new slip constructed by the Lake Shore railway on the Main river at Ashtabula is to be lengthened 80 ft. at once.

The tonnage tax bill passed the house of representatives of Michigan last week. The bill provides for the taxing of lake vessels hauling from Michigan ports on the tonnage basis of 15 cents a ton instead of the advalorem basis.

The steamer Griffin while leaving the port of Ashtabula last week had trouble in the bend at the swing bridge and raked a building adjoining the dock, as well as disarranged the draw so that it could not be entirely closed.

Mr. H. C. Burrel has asked the city of Lorain for the privilege of constructing a dock on the city's east side river property. It is Mr. Burrel's intention to operate a boat between Cleveland and Lorain during the summer.

Mr. C. C. Philpott, who for the past two years has been connected with W. R. Bartlett, steamship agent at Cleveland, has recently been appointed traveling freight agent for the Montreal & Lake Superior Line and Canadian Northern Railway.

The old wooden propeller Interocean is being dismantled at Buffalo. For the past year she has rested on the bottom in the Erie basin, Buffalo. C. S. Mahoney of Buffalo sold her lately to Frank Lenahan. Her engine and boiler will be taken out and her hull probably used for fire wood.

Wm. Frederic Carroll acting as his own attorney in the suit against the Eastern Fire Insurance Co. and German Fire Insurance Co. won his case and recovered judgment in admiralty for the full amount of the policies. They were ordinary fire policies with the 80 per cent clause attached. The vessel Gordon Campbell will now be sold to satisfy the claims of the creditors. Mr. Carroll purposes in the future to make a specialty of insurance and admiralty law.

Mr. Frank E. Kirby of Detroit announces that he will retire from active business next fall and will move to New York where his father and mother reside. Mr. Kirby has been for thirty years connected with ship building on the great lakes and is one of the foremost of American naval constructors, being a bold and original designer. He is responsible for the present type of ice crushing car ferry on the great lakes and a number of the side-wheelers are also of his handiwork.

The old Anchor Line steamer China, recently purchased by the Merchants' Montreal Line has been towed to Toronto to receive new boilers, have her engine compounded, and to receive a thorough overhauling before going on the route between Montreal, Cleveland, Toledo, Detroit and Windsor. The old boiler was removed at Buffalo and will be replaced by two new Scotch boilers. Her owners claim she will be able to make 12 miles an hour. A contract has been made whereby she will carry large quantities of Canadian whisky from Walkerville to Montreal.

PERSONAL

Lieutenant Dovale, who has been for a number of years in charge of the Hydrographic Office at Cleveland, has been transferred to the Philippines, where he will be connected with the Coast and Geodetic Survey service. During Lieut. Dovale's stay in Cleveland he earned the respect of the entire vessel community of the great lakes.

John Hossack, formerly with the Anchor Line, has been appointed eastern agent of the Detroit & Buffalo Steamboat Co. with headquarters at New York.

Mr. F. W. Miltonberger has been appointed traveling passenger agent of the Cleveland & Buffalo Line, with headquarters at Cleveland.

Col. J. J. Sullivan of Cleveland visited Conneaut last week with a view of establishing a banking institution there.

Mr. Harry Coulby, president and general manager of the Pittsburg Steamship Co., visited Duluth last week.

OBITUARY

Mr. Chas. F. Dunbar, one of the best known dredge men on the great lakes died at Buffalo last week. He had not been active in business for ten years. Mr. Dunbar was sixty-six years old, having been born in Boston in 1839. He received a common school education and his first employment was that of fireman on a dredge when he was fourteen years old. He therefore gravitated naturally into the dredging business. His name is known from one end of the lakes to the other because of his invention in 1876 of a submarine drill used in dredging rock. Although he never pretended to be an engineer it is conceded that this one invention revolutionized engineering methods in dealing with subaparine rock. Mr. Alfred Noble, now on the commission to look over plans for the Panama canal, said that Mr. Dunbar was the greatest natural engineer he ever knew.

While trying to avoid a swinging ore bucket on the deck of the steamer Luzon, Capt. Albert E. Huff stepped into an open hatchway falling upon a pile of ore and fracturing his skull. He was instantly killed. Capt. Huff was forty-five years of age and had followed the lakes for many years. At the time of his death he was assistant night superintendent of the Lackawanna Steel Co.

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FLOATING DRY DOCK FOR THE PHILIPPINES

Officials of the bureau of yards and docks of the navy department authorize the Washington correspondent of the Review to state that the department has not as yet taken up the question as to whether the large floating dry dock now nearing completion at the ship yard of the Maryland Steel Co., Sparrows Point, Md., shall be towed to her permanent station in the Philippines by the government or by private contractors. The bureau of yards and docks has lately been in receipt of numerous inquiries on the subject from steamboat and tow boat companies, but to all such queries answer is being made that the matter will probably not be determined for some time yet.

The officials at Washington are proceeding on the theory that there is no need for haste. To be sure it is expected that the dock will be completed early this month but the official test which is to take place in Chesapeake bay at a point about sixty miles from Baltimore will probably not be held until the latter part of June. It is desired to use for this test one of the heaviest battleships in the navy and it is not likely that such a vessel will be available prior to the middle of June. Regardless of when the official test may be made it is the expectation that the departure of the dock for the Philippines will be deferred until September in order to avoid the hurrican season on the Pacific.

In the matter of towing the dock there are not many precedents to guide the officials in determining whether the government or private contractors shall undertake the work. The Algiers, La., floating dock, which was also built by the Maryland Steel Co., was built under a contract which called for delivery at the mouth of the Mississippi and consequently the Maryland company contracted with a tow boat firm to deliver the dock without consulting the navy department in the matter in any way. However, the government, when it brought the Havana dock from the Cuban to the Florida coast, engaged the services of a towing company and it is recalled that Great Britain, when she sent out the Bermuda dry dock, entrusted the work to private contractors.

However, the navy has plenty of vessels qualified to take the dock in tow should it be deemed advisable for the government to handle the dock on its long journey. At the bureau of yards and docks it is suggested that in case the department is called upon to tow the dock there will probably be employed for the purpose either a cruiser or collier assisted by several of the most powerful ocean-going tugs at the disposal of the department. In this connection it may be noted that when the original Bermuda dock—the first floating dock ever constructed—was built in England in 1869, it was towed to its destination by the British warships the Agincourt and the Terrible.

The journey of the new dock from Solomon's island at the mouth of the Patuxent river (Chesapeake bay) where the official test will take place to the naval station at Clongapo, Subig Bay, P. I., aggregates 14,000 miles and is, of course, the longest distance ever traveled by a floating dock.

The new floating dry dock for the Philippines is the largest dock ever constructed. The contract specifies ability to lift a 16,000-ton battleship, but in reality the dock will have a maximum lifting power of 20,000 tons. The Algiers dock has a lifting capacity of 17,500 tons and the present Bermuda dock has a capacity of 16,500 tons. The contract price of the dock was $1,124,000 and its dimensions are 500 ft. length, 100 ft. width between fenders and 42 ft. height on the side walls clear above the pontoon deck. Provision has been made on the dock for quartering nine officers and twelve men and the equipment of the dock includes an electric light plant, distilling apparatus and machine shop.

RECIPROCITY IN STEAMSHIP SURVEYS

The close of the present week is expected to witness the formal adoption of a reciprocal agreement between the United States and Great Britain regarding the acceptance by each of the other's official surveys of the steamships at the various ports of the two powers. This "understanding," which it will readily be appreciated is of the utmost importance to shipping interests, has been brought about after protracted negotiations between Sir Mortimer Durand, the British ambassador at Washington and the secretary of the department of commerce and labor, acting through the state department, which, of course, has direct jurisdiction in all such international matters.

Under the agreement each government will accept the surveys of steamships of the other, so far as relates to hulls, boilers, machinery and life-saving appliances. The agreement accords with a practice which has been in vogue since 1876, but it has only recently been found necessary to enter upon new negotiations respecting the subject.

A similar agreement has been entered into between the United States and Canada with reference to the vessels on the great lakes. In addressing the secretary of commerce and labor on the subject a few days since Mr. F. Courdeau, deputy minister of marine and fisheries of the Dominion telegraphed as follows: "An order has been passed by the Canadian government to accept United States certificates of inspection on board United States steamers in Canada except so far as will enable inspectors to ascertain that the condition of the vessel, her boilers and life-saving equipment are as stated in the certificates of inspection."

Under the terms of the agreement the certificates of inspection issued by the Canadian authorities will be accepted by United States inspectors at ports in this country and the necessary order to that effect will be issued to port officials in the United States by the department of commerce and labor in the immediate future.

CONTRACTS FOR SCOUT CRUISERS AWARDED

After considering at length the large number of bids submitted for the construction of three scout cruisers recently authorized the secretary of the navy has awarded contracts as follows: Contract for cruiser No. 1, the Chester, to the Bath Iron Works of Bath, Me., for the sum of $1,688,000. The department's plan for hull and general arrangement of machinery is to be followed but the bidder's plan is adopted in so far as it contemplates the installation of the Parsons steam turbine.

Contract for cruiser No. 2, the Birmingham, to the Fore River Ship Building Co. of Quincy, Mass., for the sum of $1,556,000, delivery to be made in thirty months. In the case of this vessel the department's plans are to be followed throughout, not only as regards hull and machinery, but also with reference to the installation of reciprocating engines.

Contract for cruiser No. 3, the Salem, to the Fore River Ship Building Co. for the sum of $1,556,000, delivery to be made in thirty-four months. This vessel is to be constructed on the department's plans for hull and general arrangement of machinery, but with the adoption of that feature of the bidder's plan which contemplates the installation of the Curtis steam turbine. The bid accepted in the case of this vessel also specifies the department's arrangement of Fore River water-tube boilers instead of the Bowles arrangement of boilers as offered in an alternative bid.

Both successful bidders are understood to have proposed slight deviations from the department's stipulations as to the arrangement of boilers and a proviso tacked on to the contracts just awarded specifies that details of machinery arrangement, if not strictly in accord with the department's original plans must be wholly satisfactory to the bureau of steam engineering of the navy.

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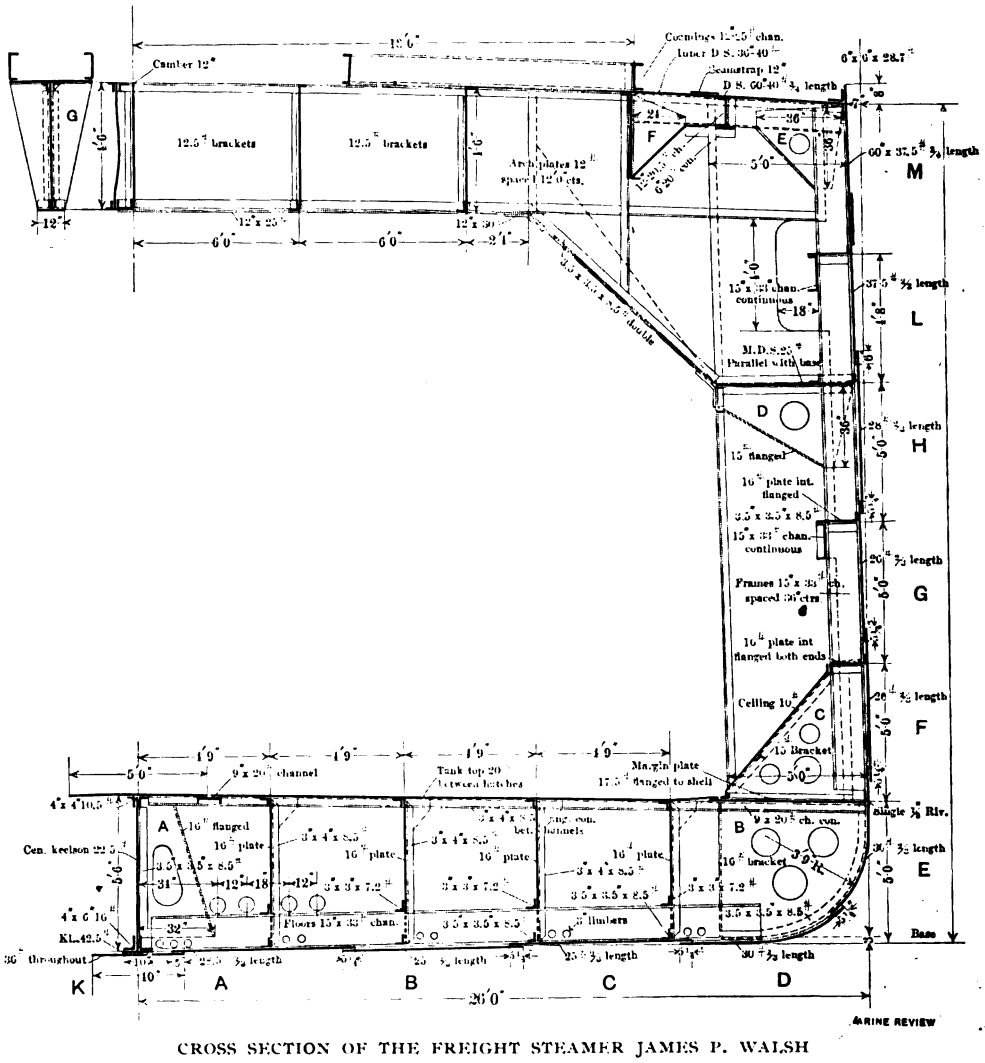
FREIGHT STEAMER JAMES P. WALSH

The freight steamer James P. Walsh, building at the yard of the Craig Ship Building Co. for Mr. C. O. Jenkins and others of Cleveland will be launched during the present month. She is 500 ft. over all, 480 ft. keel, 52 ft. beam and 30 ft. deep, and is to be equipped with triple-expansion engines 22½, 36 and 60 in. cylinder diameters by stroke of 42 in. Steam is supplied by two Scotch boilers, 13 ft. 9 in. by 11 ft. 6 in. She will have a carrying capacity of 8,000 tons. As shown from the cross section published herewith she is built upon the girder system of construction which has proved so popular in latter-day freighters. This system obviates possible interference by stanchions or stringers with the unloading machines and greatly facilitates the work of unloading. With few exceptions this system has been followed on all of the large sized ore carriers built during the past year.



CROSS SECTION OF THE FREIGHT STEAMER JAMES P. WALSH

FREIGHT SITUATION

The April movement of ore will exceed 1,000,000 tons, which will, of course, amplify to that extent the available stocks on dock May 1. The figures showing the actual amount on dock May 1 will be published in next week's Review. They are known to be low. Various conditions in addition to the ice congestion have contributed to make the season a backward one and the ore movement will not be well under way until the middle of May. Ore has not been going forward freely to the shipping docks as yet, and vessels have experienced some delay in getting cargoes. Installations of new machinery were made at the mines during the winter and everything is not as yet in good running order.

The experiences of vessels in the ice during April have been such that the experiment of attempting to use them as ice crushers will probably not be repeated. The modern ore carrier is not built to buck ice and it cannot do it without inflicting serious injuries upon itself. If they are to buck ice, more and heavier material will have to be worked in at the bow. The dry docks are so crowded with repair work that vessels which have injuries above the water line are making another trip without having the injuries attended to. The steamers that lost a blade or two from their propellers are being repaired without going into dry dock, the stern being raised by weighting the bow.

Soft coal shippers who have not been forwarding to consumers direct have not been very much in evidence so far this season but have been cleaning up their docks at the head of the lakes. The Pittsburg Coal Co. has not begun to load at Cleveland, but the word to begin forwarding is expected to come from the Pittsburg office at any time. Hanna & Co.'s shipments have been about normal so far this season. Not much is being said about the new Hanna dock at Superior and future plans will not be announced until all contracts have been closed up.

TOWING

President Smith, Capt. Thos. Johnson, assistant to the president, and Capt. W. H. Hill, superintendent of properties of the Great Lakes Towing Co., have just completed a trip of inspection to Erie and Conneaut, where they looked over the situation and found everything satisfactory.

Next week they will visit Ashtabula and Fairport. The tug Annie, which has been out of commission since 1903 has been rebuilt and was inspected by the local inspectors. She will go into commission at Fairport, taking the place of the tug Byers, which has been leased to the Detroit Dredging Co. The wrecker Saginaw, which has been stationed at Detroit will go to Buffalo as soon as the ice permits. The lighter Noyes, now at Escanaba, will go to Buffalo with the Saginaw.

With the increase of business into Buffalo and the lower end of Lake Erie, especially to the new furnaces of the Lackawanna Steel Co., the necessity of a wrecking outfit at Buffalo has become imperative. Heretofore the only wrecking facilities have been tugs and fuel scows used as lighters and the work has not been satisfactory. With the dense smoke from Buffalo and only two miles leeway between Waverly shoal and Point Abino, navigation has been hazardous in thick weather and the underwriters have suggested the advisability of additional wrecking facilities. In the case of the steamer Appomattox part of the cargo had to be thrown overboard. The Great Lakes Towing Co. officials will visit all points on the lakes where they have plans within a short time and make plans for the betterment of the service.

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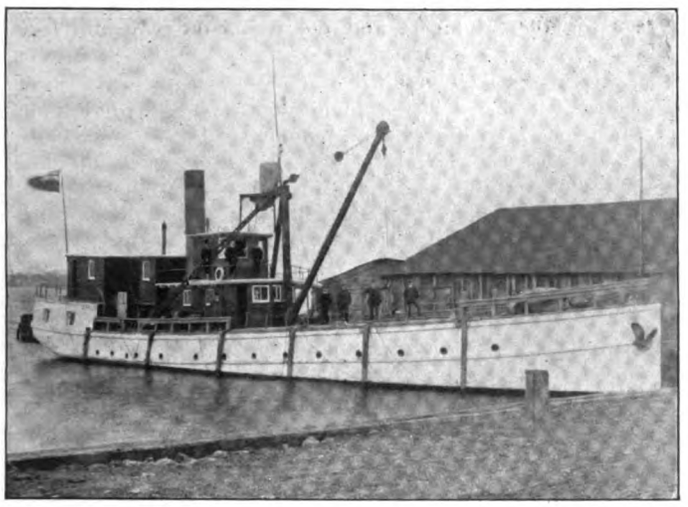
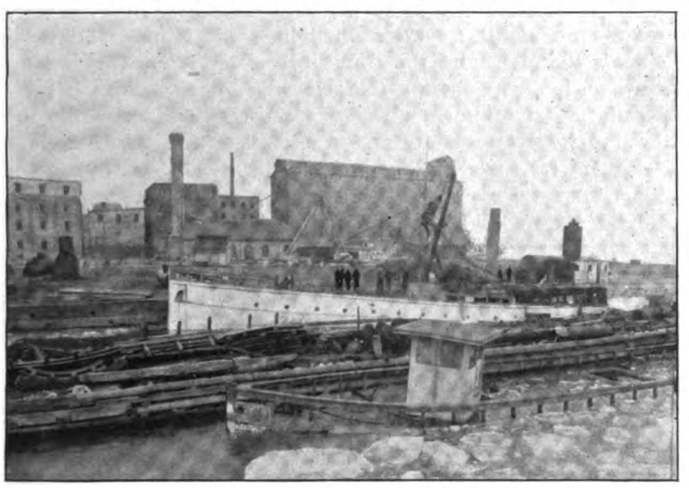
THE EXPLOSION ON THE SCOUT

On this page will be found some graphic photographs showing the government steamer Scout after the explosion of



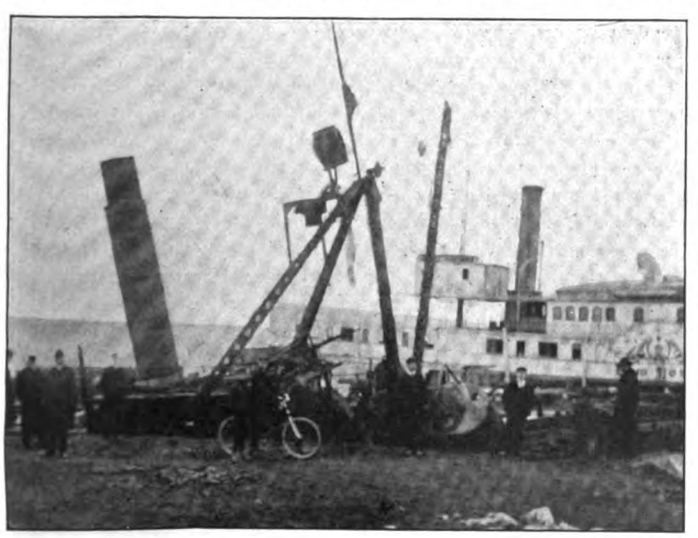
Showing the Scout before the accident but minus some buoy machinery that afterwards occupied the bow deck. Capt. William Allison is standing on the bridge with his hand on the wire guy. The mate, Fred. Mullin, is standing in front of the pilot house. Both these men were killed.

acetylene gas in the buoys lying alongside the dock at Kingston recently. The Dominion government is now making a



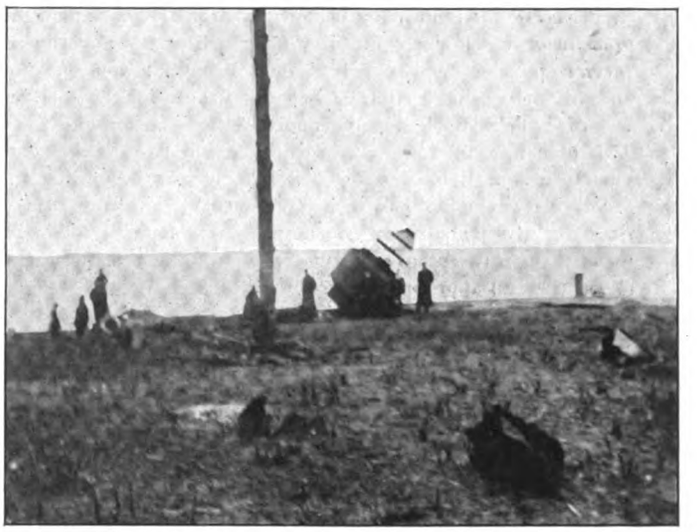
Port side of Scout after she was raised.

careful inquiry into the causes of the explosion in order to deduce data for future guidance. The explosion was terrible,



Starboard side steamer Scout showing the tank in which the acetylene gas is mixed. This tank had several breaks in it made by the flying metal.

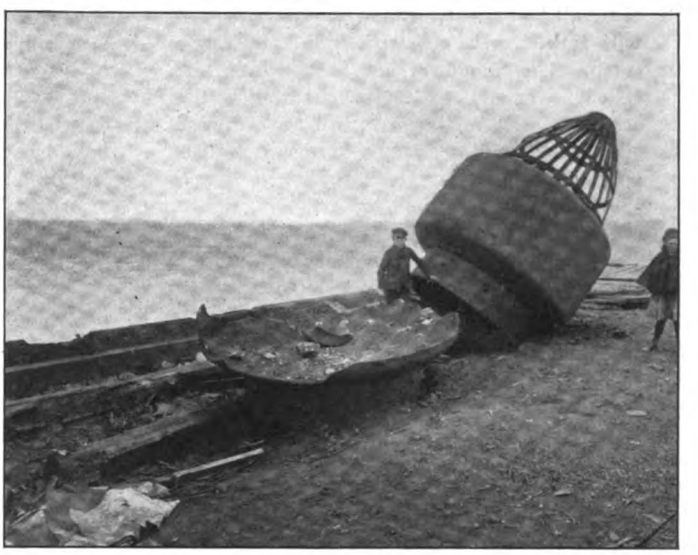
four men losing their lives and a number being injured. There were three buoys in the dock but only two of them exploded. The two buoys that exploded had been filled for about a half hour before the explosion took place. The pressure was 180 lbs. Some doubt is expressed as to whether the buoys were ever intended to withstand such a pressure as this, but the fact remains that they had been subjected to it since they were secured from the manufacturers in 1901. No guarantee



Buoy intact with portions of the exploded buoy in foreground.

of pressure was given by the manufacturers; nor did the government make a trial test of the buoys except such as they received in service. The best information at present obtained is that the explosion was due to a defective well in one of the buoys.

Undoubtedly greater care will have to be exercised in the use of this gas in the future though this was the first instance



Showing one gas buoy intact, the bottom of one of the exploded buoys and the fragments of the third buoy in the left hand corner. The line of weld is about on a line with the knees of the little boy.

of serious trouble that the Dominion government has had with acetylene. Acetylene gas is at present used in fourteen light-houses and three light ships in the Dominion. All the gas buoys between Montreal and Kingston, the gas buoys in Parry Sound district, Halifax harbor and between Sorel and Montreal burn compressed acetylene.

The Steamer Turbina has had one of her propellers replaced, in the drydock at Kingston, Ont., prior to going on the Toronto-Hamilton run for the season.

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PROGRAM FOR TENDERS AND LIGHTSHIPS

The construction department of the United States lighthouse establishment is just now busily engaged upon the preliminary work for a rather pretentious program of new construction embracing both lighthouse tenders and lightships. Work is well under way on the plans and specifications for three new steel tenders for the fourth, sixth and eleventh districts respectively, for which full appropriations have now been made by congress. It is in many instances customary to begin work upon new vessels designed for this branch of the government service as soon as congress makes an initial appropriation and authorizes that a contract be entered into, for the carrying out of which supplementary appropriations are made later. This plan was not followed, however, in the case of the three vessels in question. To be sure, the appropriation for the fiscal year beginning July 1, 1904, did carry initial appropriations for the trio of new steamers, but work was not commenced upon the plans until congress at its last session completed the full appropriation required.

For the new tender for the fourth district, with headquarters at Philadelphia, there is available the sum of $125,000; for the vessel for the sixth district with headquarters at Charleston, S. C., the sum set aside is $130,000 and for the eleventh district vessel designed for service on Lake Superior, the contract may call for any amount up to $140,000. The architects and engineers of the lighthouse establishment have also taken up the formulation of plans for the new lightship authorized by the last congress for service at Brunswick, Ga., but as yet no move has been made to prepare drawings for the new tender authorized by the last congress to replace the tender Cactus in the third district. For this vessel congress has made an initial appropriation of $50,000 and authorized entrance into a contract for a sum not to exceed $135,000.

For the Philadelphia, Charleston and Lake Superior tenders the names Sunflower, Cypress and Anemone has been selected, the officials adhering to their past policy of naming all tenders for flowers or plants. These vessels for which bids will be invited within a few weeks are all of a size which will permit their construction in either coast or lake shipyards. The Sunflower, the fourth district vessel, will be 173 ft. 9 in. over all; 163 ft. 6 in. in length on the water line; 31 ft. beam; 15 ft. 5 in. depth; 10 ft. 6 in. draught. 800 tons displacement; twin screws with propellers 7 ft. 6 in. of the built up pattern with detachable blades. Power will be furnished by vertical, inverted, direct acting, open front, surface-condensing, triple-expansion engines of 800-H. P., capable of driving the vessel at a speed of from 10 to 12 knots per hour and to which steam will be supplied from two Scotch boilers working at a pressure of 175 lbs. The engines are 12, 19 and 32 in. diameter of cylinder by 24-in. stroke, and the boilers are 11 ft. 9 in. shell and 12 ft. over heads. The boilers have a grate surface of 45 sq. ft. and a heating surface of 1,580 sq. ft. Two Fox corrugated furnaces are fitted. The single condenser (4 ft. diameter and 1,500 sq. ft. of cooling surface) is a feature of the machinery equipment for the reason that it is constructed of Benedict nickel steel instead of brass, as has been customary in former practice.

This vessel, alike to all the new tenders will be built in accordance with the rules of the American Bureau of Shipping. The Sunflower will be fitted with a foremast but will carry no sails. She will have the usual derrick boom for handling buoys, etc. She will have 135 tons coal bunker capacity; a 15 K. W. electrical plant for 138 lights, two stockless anchors, steam steering gear, steam windlass, steam capstans, and a full equipment of fire, bilge, feed, sanitary and circulating and other pumps of Blake or other approved pattern. The vessel will carry a complement of five officers and twenty-two men. The pilot house will contain master's room and bath. The upper deck will be given over largely to quarters for the inspectors, comprising saloon, staterooms, baths and toilets. Forward on the main deck will be the officers' mess, galley, baths, etc., while aft on this deck are quarters for the engineers and quartermaster. In the fore hold are quarters for the crew.

The Cypress, which is to be built for service in the sixth district will be a virtual duplicate of the Sunflower in dimensions, machinery and equipment save for a few minor features. The principal departures from the design above outlined are found in the fact that the Cypress will carry sails and that she will have a draught of only 9 ft. instead of 10 ft. 6 in.

The Anemone for service on Lake Superior will be approximately 173 ft. 5 in. on the waterline, 30 ft. beam, 16 ft. depth, 11½ ft. draught and 850 tons displacement. She will be a single screw steel steamer, fitted with triple-expansion engines of 1,000 H. P., cylinders 16, 25, 42 in. by 28 in. stroke capable of giving her a speed of 13 knots per hour. The work on the plans and specifications for the Anemone have not progressed as far as those for the other two vessels but it is known that in almost all the details of equipment she will conform closely to the other two vessels. However, the Lake Superior tender will be fitted with a main deck of steel in deference to the well known preferences of great lakes navigators.

The new lightship for Brunswick, Georgia will be very similar to four or five vessels constructed during recent years for similar service including the Cape Lookout Shoals lightship and the Blunt's Reef lightship, the latter now on her way around Cape Horn to her station on the Pacific coast. The new vessel for the Georgia coast will be 135 ft. over all, 113 ft. on the waterline, 28 ft. 6 in. beam, 15 ft. 4 in. depth, 12 ft. 7 in. draught, 621 tons displacement. Power is furnished by one vertical compound engine of 380 H. P. with cylinders 16 and 31 by 24 in., 130 revolutions, to which steam is supplied from gunboat type of boilers 16 ft. 4½ in. in length and 9 ft. 3 in. in diameter, working at 100 lbs.

The United States lighthouse steamer Violet has arrived at Baltimore for extensive repairs to hull and machinery and Lightship No. 172 which is to take her station at Drummond shoal is also being given a thorough overhauling.

Capt. J. Fred Tribble, No. 43 Broadway, Norwich, Conn., has invented and patented a device for locating sunken vessels. The device is very simple, indeed, and is in the form of an air buoy, constructed with air-tight compartments. It has a separate compartment at the lower end at which a reel is arranged with a line made fast at one end to the shaft of the reel, marked in fathoms, passing through a hole which is bushed with Babbitt metal to prevent chafing. The other end of the line is fastened to a ring bolted on the vessel's deck and the buoy is thus always ready for use. Should the vessel sink the buoy floats and the line unreels until the vessel strikes bottom, thereby locating the exact position of the sunken vessel. The statistics indicate that the device would be of real service for the report of the commissioner of navigation shows that from 1885 to 1903 5,719 vessels were sunk. The buoy is also adapted as a mooring buoy for yachts of all sizes for indicating fishermen's trawls, lobster pot buoys and in fact for every floating property. The patent is for sale.

The torpedo boat Stringham, built by the Harlan & Hollingsworth Co., Wilmington, Del., has been accepted by the secretary of the navy under authorization of congress. The Stringham at the time of her trial failed to reach her contract speed of 30 knots.

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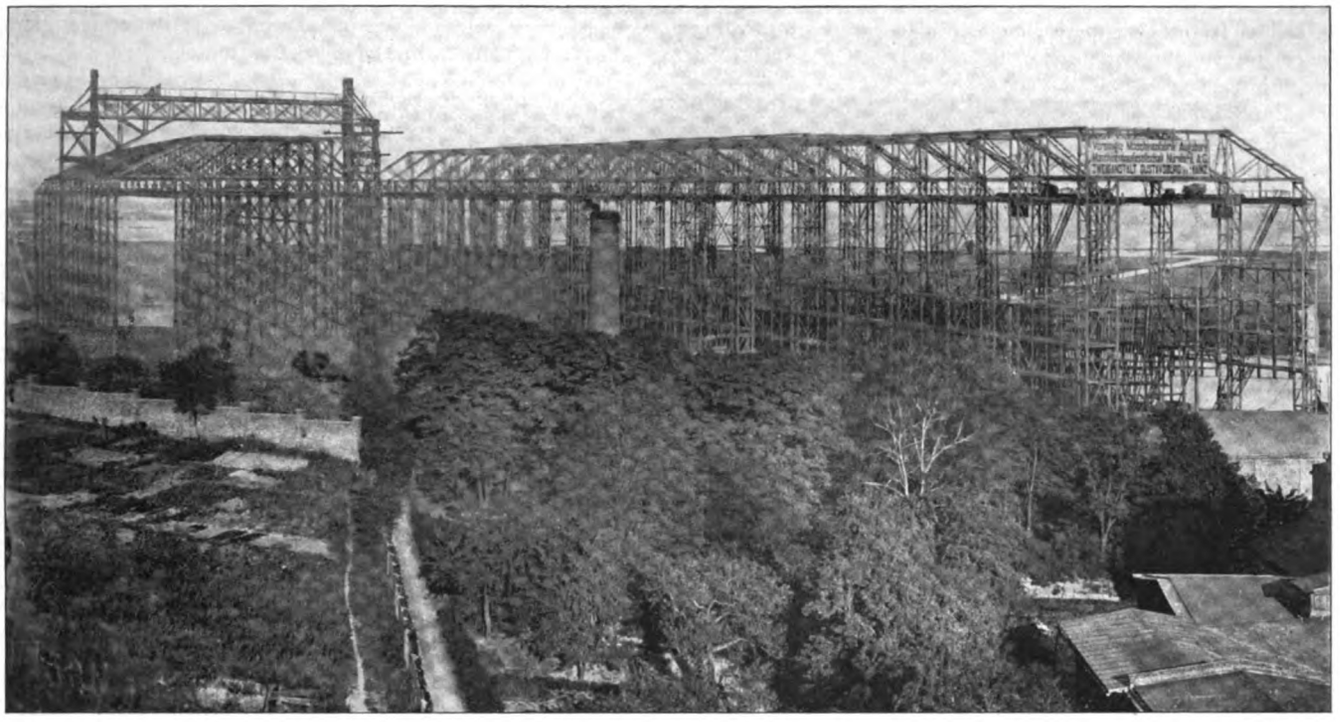


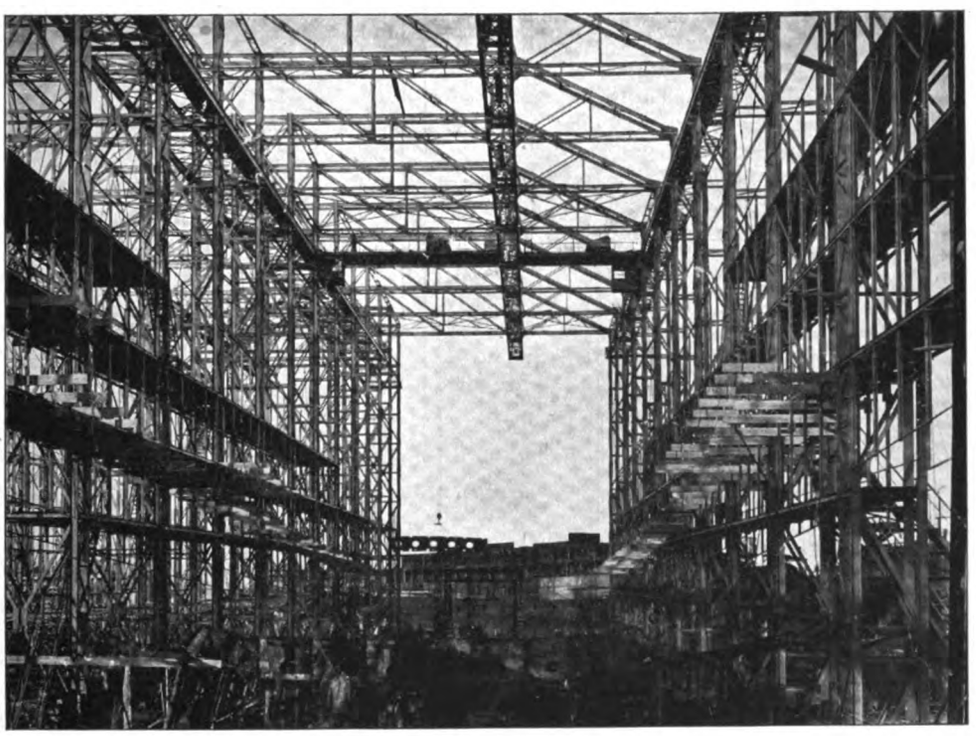
STEEL SHIP BUILDING SLIPS AT VULCAN PLANT AT STETTIN.
[Built by Vereinigte Maschinenfabrik Augsburg und Maschidinenbaugesellschaft, Nurnberg, A. G.

Steel Ship Building Berths

By F. H. Rudolph, A. M. I. M. E.

In ship building as well as in other industries where steel is the principal material employed, large quantities and heavy weights have to be handled in the shortest possible time. Some decades ago, when ships were principally built of wood and had only a small tonnage, the wooden staging of the building berths were quite sufficient, but times have changed and steel has rivaled out the wood.

In order to meet effectually the requirements in building one of the modern giants of the Atlantic in a short time, the antiquated shipyards had to be remodeled and to be transformed into efficient workshops, lifting and conveying plants of the highest capacity had to be installed. As the conveyance and handling of the great quantites of material represent two of the largest items in the cost of the vessels, the reduction of these to a minimum by means of suitable and efficient plants was imperative. But apart from the time thus saved, such plants tend also largely to independency of human labor and afford a greater safety in the handling of the larger parts, in short, facilitate construction to a great extent.



STEEL SHIP BUILDING SLIPS AT STETTIN.

The right recognition of these facts led in 1900 the Stettiner Maschinenbauktiengesellschaft Vulcan to erect the highly efficient building slips which were constructed by the Gustavsburg branch works of the Vereinigte Maschinenfabrik Augsburg und Maschinenbaugesellschaft Nürnberg, A. G.

The ground plan given in Fig. 1 shows the situation of the new steel structure which has replaced the old wooden staging. The

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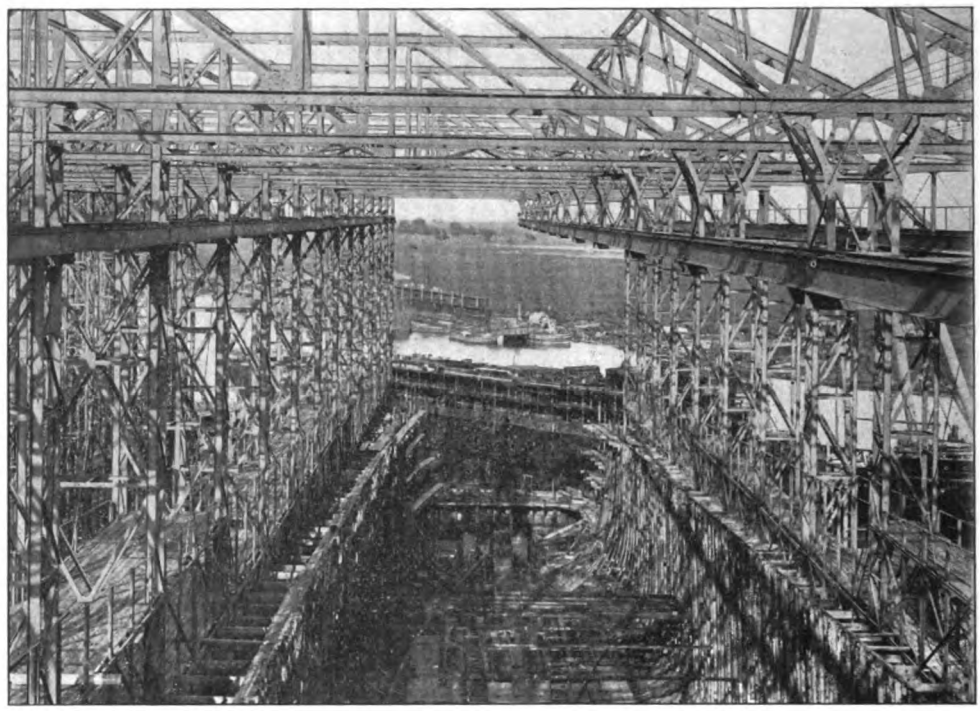
principal features of these slips are huge gantries straddling over the building berths for the purpose of receiving the tracks for cranes and several working platforms. One large and one smaller slip were arranged so as to form one common structure. On account of the different lengths of the slips the end sections are unsymmetrical. The last outer columns are common to the two pairs of slips.



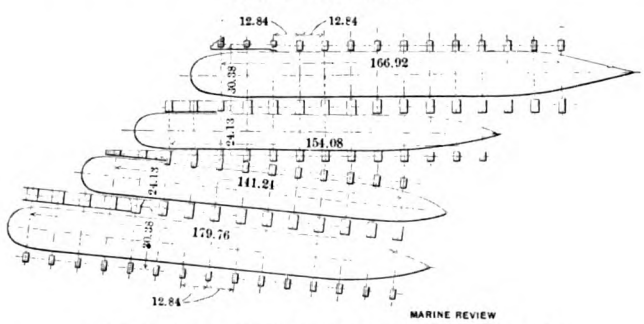
STEEL SHIP BUILDING SLIPS AT STETTIN.

The columns and cross girders of the supporting structure are 12.84 metres (42 ft. 1 in.) apart. The former rest on granite blocks which are firmly connected with the foundation by means of strong holding-down-bolts. The longitudinal forces brought about by wind pressure and crane traveling are transferred to two pairs of braced up columns by means of the continuous working platforms, crane girders and longitudinal connections, especially provided for this purpose between the cross girders.

The diagram given in Fig. 3 shows the four times statically undetermined system of the structure. The statical computation was based on the following assumptions: The points I and K are to be considered as hinges common to both, I and II, X, Y, Z and W as moveable, A, B, C, as fixed hinges and the member G-H as a longitudinally moveable bar. The strains were computed graphically by means of the "Williot" diagrams whereby the influence by the ranges of temperature was duly taken into consideration. For dimensioning the structure a stress of 1,000 kg/qcm (6.35 tons per sq. in.) was allowed for mild steel.

Each gantry received two traveling cranes. The tracks of these cranes are supported at the columns by means of

Fig. 1. GROUND PLAN.



GROUND PLAN OF BUILDING SLIPS AT STETTIN.

brackets, while they are suspended in the middle at the cross-girders in a manner clearly shown in our illustrations. This arrangement has the advantage that both sides of the ship can be served by the cranes independently of each other. The travelers are of different lengths so that one will always be able to deal with weights immediately over the center line of the ship. Thus in the larger berths the cranes are of 49 ft. 10 in. in length, while in the smaller berths the respective lengths are 22 ft. 9 in. and 39 ft. The crane girders received a horizontal lateral bracing which prevents their bending out sideways and at the same time serves as a support for the planking of the footways. Each track is fitted, so far, with one 4-ton crane, but a second one of equal capacity is under consideration. The cranes are operated electrically with polyphase current of 500 volts pressure and 50 periods per second. There are three separate motors for each traveler, with distinct gearings, so that all movements of the crane are entirely independent of each other. The respective

Fig. 3

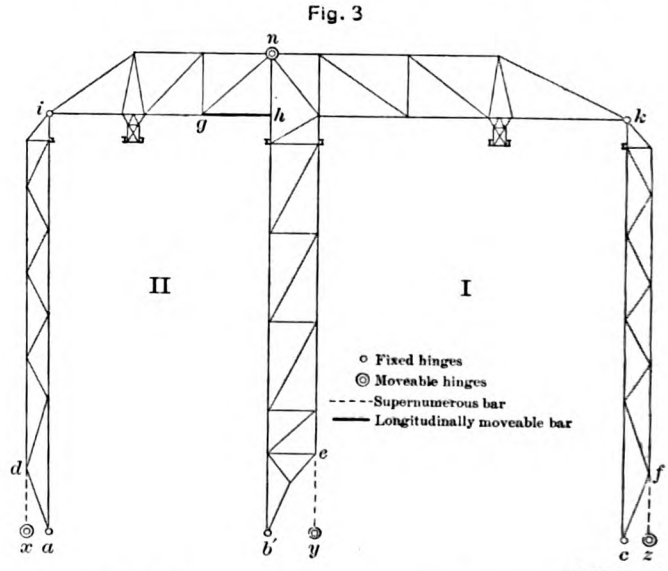


DIAGRAM OF SECTION OF BUILDING SLIPS AT STETTIN.

speeds are 32 ft. 10 in. per minute for lifting, 65 ft. 7 in. per minute for crab traveling, 262 ft. 4 in. per minute for crane traveling; the greatest height of lift is 118 ft. The center columns of each pair of slips are fitted with the track for a crab of 750 kg capacity for handling smaller pieces of construction.

There are four permanent working platforms, one above the other, built into the columns of the main frame and consisting of steel structure with wooden flooring. A wooden inclined gangway on a steel substructure situated on the outer side of the slips and 6 ft. 6 in. wide affords means by

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which the materials are brought to the platforms. The gradient of this structure is 1:4, 5. In addition to this flying stages can be put up from which riveting of the butts of the vessels' shell-plating can be performed. Numerous stairs connect all the working platforms with each other and with the ground and the gangways placed beside the crane girders on their bracing.

The foundations for the columns consist of concrete blocks placed on wooden piling, which are protected at the water end by a continuous line of pale-planking.

The riveting of the structure was machine made. This necessitated, as far as possible, all the work being done in the shops so as to reduce the riveting at the site to a minimum.

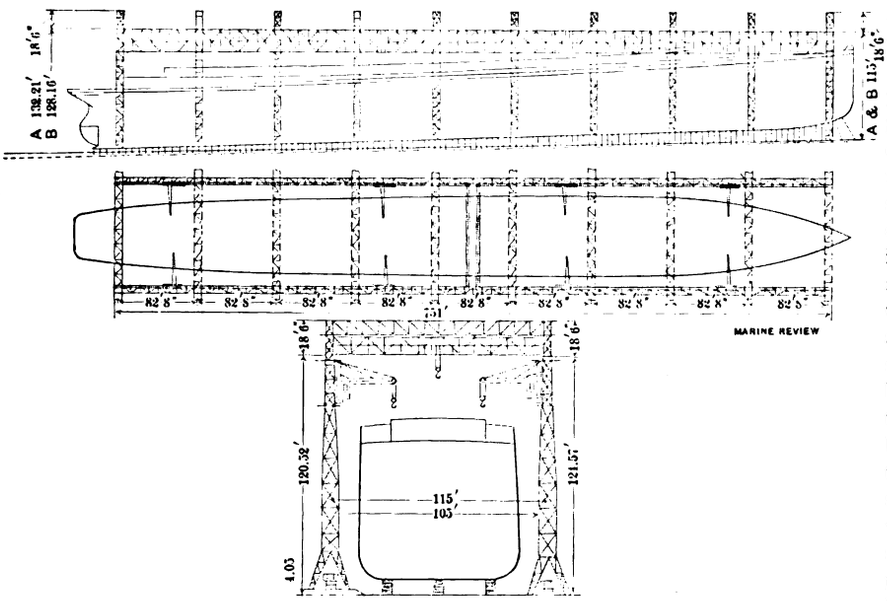
The extremely narrow site required a very careful and difficult mode of erection. The slips were erected without any scaffolding by means of a gigantic gantry crane having a clear height of 134 ft. 5 in. and a clear width of 118 ft. This crane traveled on a double track which was laid on a special piling. The crane lifted the completely riveted outer and middle columns and cross girders which were then bolted down to their respective supports. The uprights between the main columns were fixed to the working platform by workmen who had taken up their places in a specially provided cradle which was lifted by the crane. The two smaller slips were lifted by a jib crane placed on a special trestle. The erection of the main structure, including cranes, took 9 months.

The weight of the whole steel structural work was 3,600 tons.

As will be seen from our illustrations the slips were left entirely open, no glazing in of the roof or sides being applied. As reason for this it was said that a roofing materially interferes with the light and creates draughts. Even if glass were chosen for the roofing material the dirt collecting would restrict the passage of the light. It was moreover considered that the noise made by the men at work on a vessel under a roofed building slip would be unbearable and, last but by no means least, a glass roof would have considerably raised the first cost and the maintenance.

Another instance of such steel building slips are represented by the diagram in Fig. 4. These are the berths at the yard of Messrs. Swan & Hunter at Wallsend-on-Tyne, England. They are 500 ft. long, one being 72 ft. and the other 68 ft. wide; the height of the side wall is 80 ft.

The appliances for handling material consist, firstly, of a wire ropeway, the trolley of which is actuated by electricity, the traversing and lifting being effected by two winding drums which are placed in the power house. Light railway lines are laid down, by which the building material can be brought alongside the ship under construction. Over each slip two parallel runways are provided, each to receive a 3-ton electric traveler of special design. They have, as can be seen in our illustration, a horizontal swivelling arm which can be revolved and traversed at the same time, thus enabling them to serve the whole area of the berth and to reach the center line of the ship, which is a convenient arrangement, seeing that many parts put on board have to be placed at the center line. The speed of lifting is 100 ft. per minute and the traverse speed is 300 ft. per minute. A hydraulic passenger lift is provided to carry from eight to ten men to the upper deck of the vessel under construction.

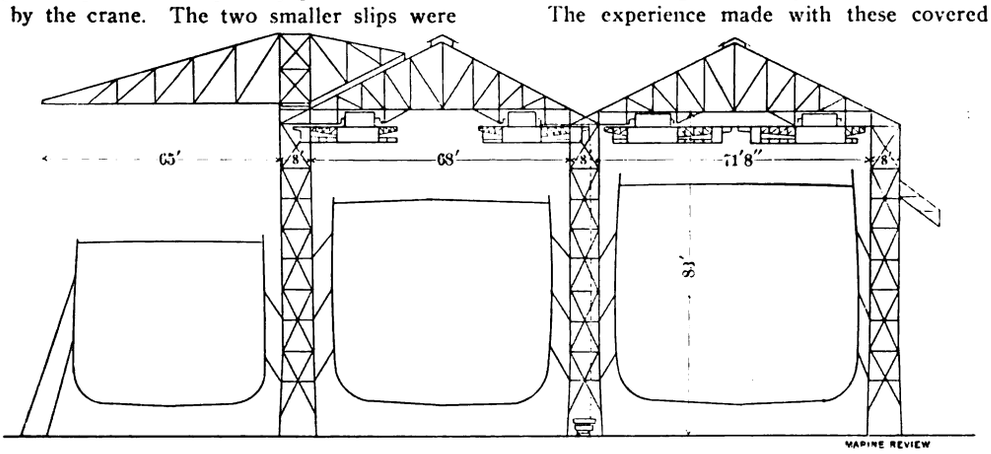


BUILDING SLIPS AT MESSRS. WM. BEARDMORE'S YARD AT DALMUIR, SCOTLAND.

A special feature of this structure is the provision of a track on the top of the eastern slip for a traveling cantilever crane which serves another berth on the principle of the Brown Hoisting Machinery Co.

The experience made with these covered slips compared with the uncovered ones may be shortly summed up as follows:

The temperature is higher in winter and lower in summer than outside. There is no complaint from the men on the score of draughts, though the slips are open at both ends. The glass roof is an obstruction to light to a small extent. The noise is considerable.



BUILDING BERTHS AT MESSRS. SWAN & HUNTER'S YARD AT WALLSEND-ON-TYNE, ENGLAND.

Yet another example for these steel slips are those at Messrs. Wm. Beardmore's new ship yard at Dalmuir, Glasgow, Scotland, which are illustrated in Fig. 5. This structure distinguishes itself from the two described above by the arrangement of its cranes. On each side of the berth four jib traveling or walking cranes are provided, having a lifting capacity of 5 tons and a reach of 30 ft. The rails for these cranes are supported by the vertical members of the shed. At the same time a high-speed traveler spans the slip, capable of dealing with weights of 15 tons. By this arrangement the sides of the vessel under construction can be served without

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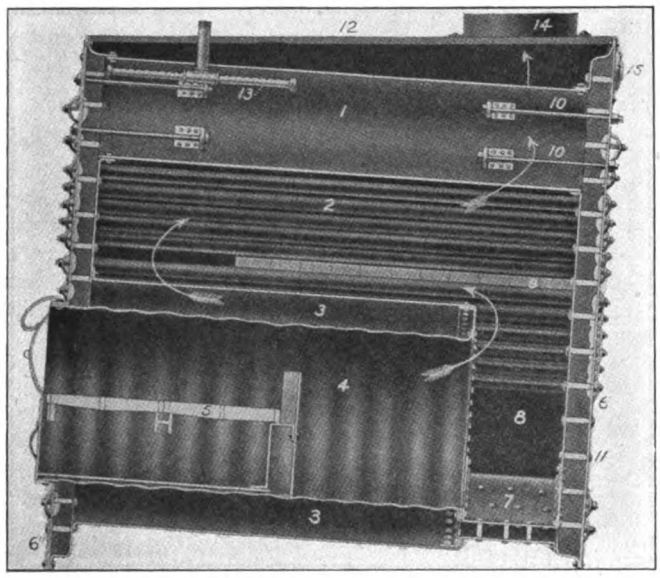
interfering with the conveyance of material to the center line. In addition to the cranes, trucks can pass between the foot structure of the verticals, as shown in the cross section, the empty wagons passing up outside.

The superstructure is 750 ft. long, 135 ft. wide and 150 ft. high. The roofing consists entirely of glass. The general construction of the steel work has no specially interesting features and requires no description as a reference to the illustration will be sufficient.

DETROIT SCOTCH WATER-TUBE BOILER

The Detroit Scotch water-tube boiler is a new, safe and very efficient pressure boiler, especially adapted for marine use, but serviceable in any location where steam is required. It combines the features of internal firing and the use of the corrugated furnace that have made the ordinary Scotch boiler so popular, particularly for marine use, with the safe and rapid steam-generating properties of the water-tube boiler, eliminating the objectionable points found in either type. The illustration herewith will make clear the construction of the Detroit Scotch water-tube boiler, but brief explanations would be as follows:

The corrugated furnace is surrounded by another shell, about 12 in. larger in diameter. The space between the two



CROSS SECTION OF 100 H.P. DETROIT SCOTCH WATER-TUBE MARINE BOILER.

is occupied by a considerable body of water, insuring quick appropriation of a large portion of the furnace heat. These double shells are inclined downwards at the back. The front ends are attached to and connected with the front water-leg. The incline permits of good circulation and liberation of steam. The water-encased furnace extends backwards from the front water-leg to within 21 in. to 24 in. of the rear water-leg. The lower rear end of the double cylinders is connected with the rear water-leg. This connection is a double segment of a circle, extending about one-third the lower circumference of the double furnace shell. The segmental part is properly stayed, and is rendered accessible for cleaning purposes through handholes inserted in the rear water-leg. This double water segment supports the rear end of the shells. The feedwater is admitted to boiler through this rear end connection. A space equal to about two-thirds of circumference of the furnace and water shells is left open for the escape of the furnace gases. The upper portion of boiler consists of a bank of several dozen water-tubes, and the steam drums.

By the use of a horizontal fire tile deflector close to the top of the water-shell, the furnace gases are returned on the outside of the latter, as well as amongst the water-tubes surrounding its upper portions, making the double water-shell very efficient in steam production. By the use of a second deflector on top of the bank of water-tubes, the furnace heat is returned a second time amongst the upper tubes, and along the lower portion of the steam drums; thence to the smoke stack, which is generally placed at the rear.

The construction of the water-legs, drums and sectional lined casing are similar to that used in the "Detroit water-tube boiler" as also manufactured by the same firm. The water-legs are double from within a few inches of the floor to the top of boiler. The drums are inserted in deep flanges turned inwards from the inner water-leg sheets, thus affording the full areas of drums, front and rear, as water and steam connections, thereby preventing fluctuations in water level. The water-tubes are independently accessible, inside and outside. The interior of the double water shell is accessible for cleaning purposes through several handholes placed opposite, and around its circumference, in the front water-leg. In the larger sizes two or three double water and furnace shells are used while the smaller boilers have only one. This special design of boiler will no doubt fill a long felt want, especially amongst boat owners and marine engineers, especially as it affords greater safety and efficiency than the ordinary Scotch boiler and has only about two-thirds the weight. They are manufactured by the East End Boiler Works, 11-19 St. Aubin Ave., Detroit, Mich., who have applied for patent.

TRADE NOTES

The National Electric Co., Milwaukee, Wis., has just issued No. 3 of its little booklets entitled Electrical Catechism. The title page quotes the definition of electricity from the modern point of view. The words are those of Sir Oliver Lodge and give one a very good idea of what electricity is. "Electricity is not a form of energy, any more than water is a form of energy. Water may be a vehicle of energy when at a high level or in motion; so may electricity. Electricity cannot be manufactured, as heat can, it can only be moved from place to place, like water; and its energy must be in the form of motion or of strain. Electricity under strain constitutes charge; electricity in locomotion constitutes a current and magnetism; electricity in vibration constitutes light."

The Westinghouse Electric & Manufacturing Co. are now preparing for distribution two fan motor folders. They are most excellently designed in pocket form and are worth writing for. One deals with the Westinghouse direct current fan motor and the other with the Westinghouse alternating current fan motor.

The J. C. Goss Co., sail makers and riggers at No. 10 Atwater street, East Detroit, Mich., have just put out an interesting catalogue devoted to their outfit. They are also makers of awnings, tents and flags—pretty much everything else involving the use of canvas and duck.

The Falls Hollow Staybolt Co., Cuyahoga Falls, O., have received a large order for Falls Hollow Staybolt iron from the western Australian government railways and also from the Cuba Co. for shipment to an important railroad in Cuba.

The schooner Camilla May Page was launched last week from the yard of James W. Hawley, Bath, Me. The Page is 175 ft. long, 36 ft. beam and 14 ft. deep. She is intended to be used in the lumber trade to the Panama canal.

McIntyre & Henderson of Baltimore, will place the machinery in the tug Alpha, built by Joseph W. Brooks & Son, at Madison, Md. When completed the tug will be in command of Capt. Ellinghaus in harbor service at Baltimore.

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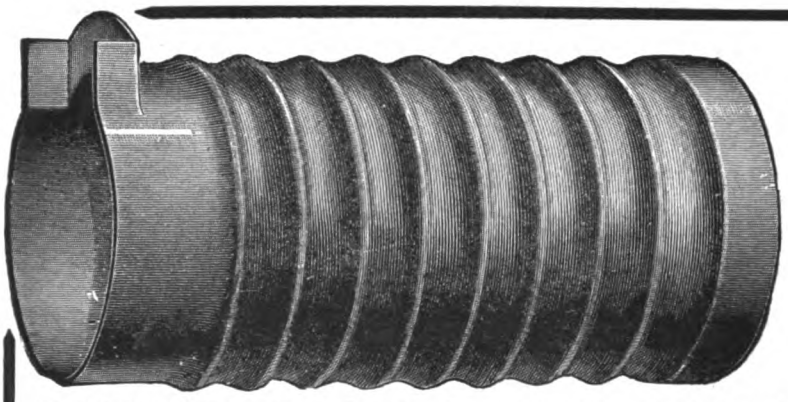

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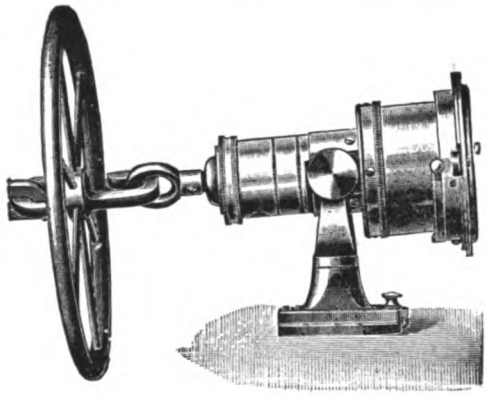

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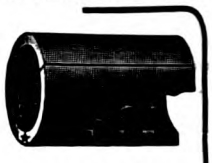

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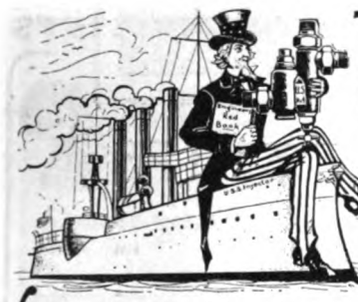

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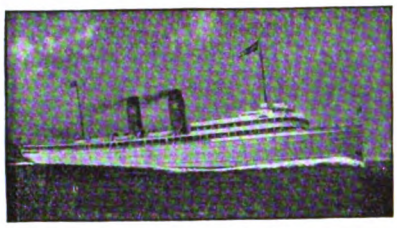


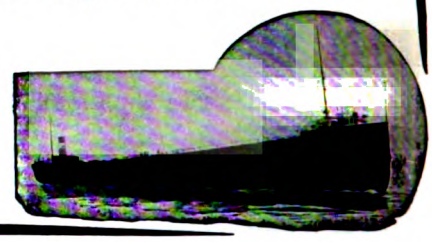
The American Ship Building Company

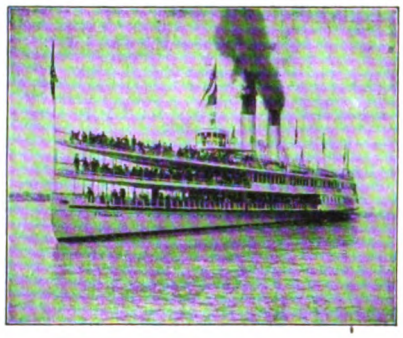
MAIN OFFICE CLEVELAND, OHIO

Marine and Stationary Engines **STEEL SHIPS** Boilers and Auxiliary Machinery

Sole Agents for the Lakes for the Ellis & Eaves Induced Draft System, as applied to boilers, giving increased power and great economy.

WORKS AT CLEVELAND AND LORAIN.





Detroit Ship Building Company

SHIP AND ENGINE BUILDERS

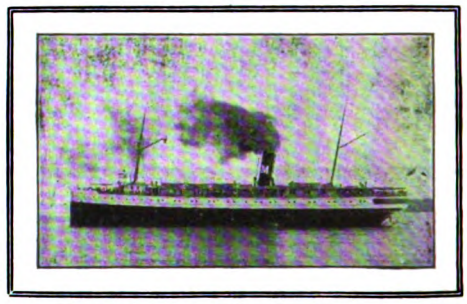
Sole Owners for the Lakes and Atlantic Coast of the HOWDEN HOT DRAFT SYSTEM as applied to Boilers, giving increased power and great economy.

Steel Ship Yard located at Wyandotte, Michigan Wooden Ship Yards and Dry Docks, Foot of Orleans Street, and Foot of Clark Ave., Detroit, Mich.

Alexander McVittie, President and Manager
William C. McMillan, Vice President
M. E. Farr, Secretary and Treasurer
Charles B. Calder, General Superintendent
Frank E. Kirby, Consulting Engineer

Wm. L. Brown, Pres. O. R. Sinclair, Sec'y and Treas.
C. Wallace, Vice-Pres. Alfred G. Smith, Gen'l Supt.

Chicago Ship Building Company

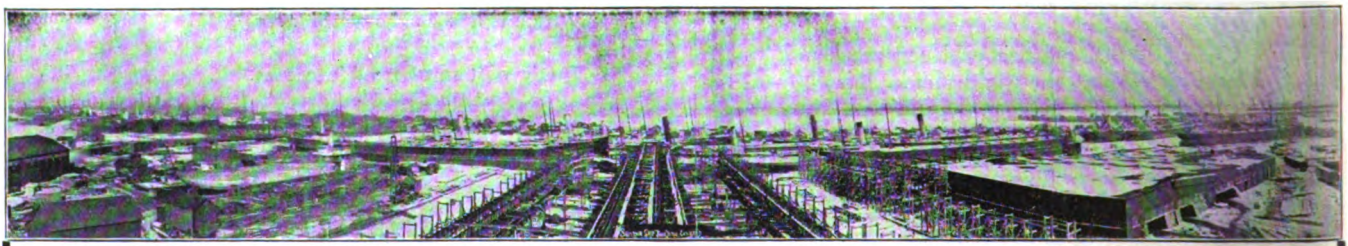


STEEL SHIPS

Passenger or Freight

ANY SIZE

Yards, Dry Docks and Repair Shops at South Chicago, Ill.



The Superior Ship Building Company

SHIP AND ENGINE BUILDERS

Dry Docks and Repairs of all kinds

Large stock of material always on hand for Repairing Wooden and Metal Ships.

Repairing promptly attended to, Night or Day.

WEST SUPERIOR WISCONSIN

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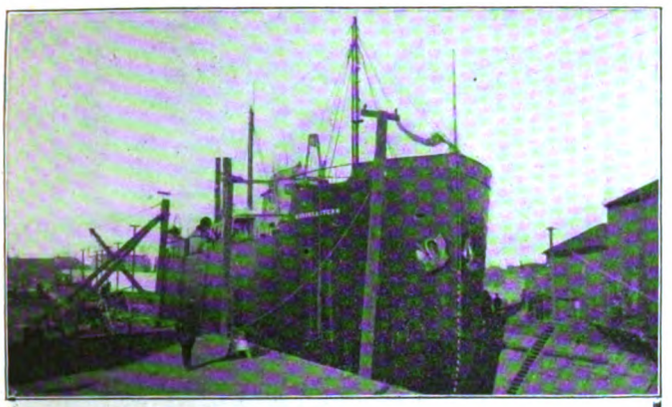


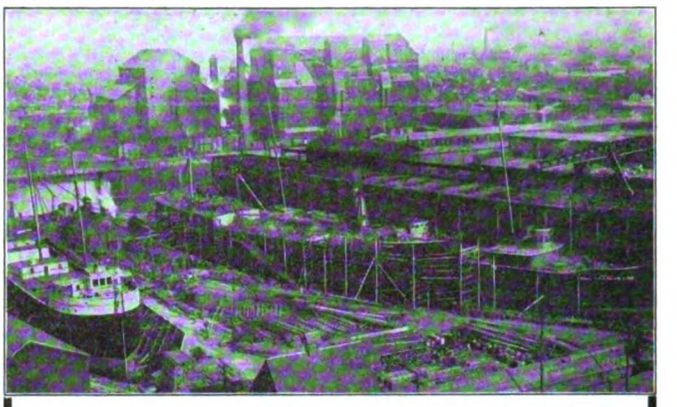
Milwaukee Dry Dock Company

MILWAUKEE WISCONSIN

SHIP REPAIRS
OF ALL KINDS

We have two ship yards offering every facility for the repair of both steel and wooden vessels. South Yard Dock is 450 ft. long on keel blocks; 460 ft. over all; 60 ft. width of gate and 16 ft. over sill. West Yard Dock is 312 ft. on keel blocks; 45 ft. width of gate and 12 ft. over sill. Rudder pit in each dock. Electric lights for night work.

MAIN OFFICE AT SOUTH YARD
Foot of Washington Street
Telephone Main 3



The Buffalo Dry Dock Company

BUFFALO NEW YORK

Operating four Docks, Sixty-Ton Shear Legs, and in every way equipped with modern plant for the building and economical repairs of **STEEL AND WOODEN SHIPS.**

EDWARD SMITH, President ADAM STEEL, Superintendent
WILLIAM KNIGHT, Ass't Sec'y and Treas.

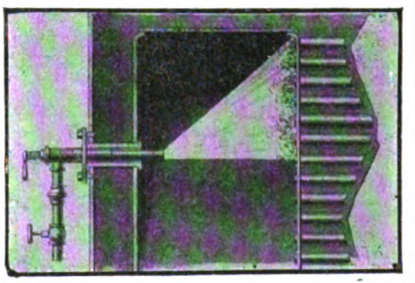
Office Telephone, 515 Seneca. President's Telephone, 3920 Seneca, Office.
President's Telephone, 209 Bryant, Residence.
Ass't Sec'y & Treas., Telephone, 609 Bryant, Residence.

The Diamond Blower.

Accept our offer to loan it to you for a thirty days' free trial. Such trial obligates you in no way to buy.

Don't Persist

in trying to clean your flues the old way. It is never very effective—besides it is unnecessary labor. Install the



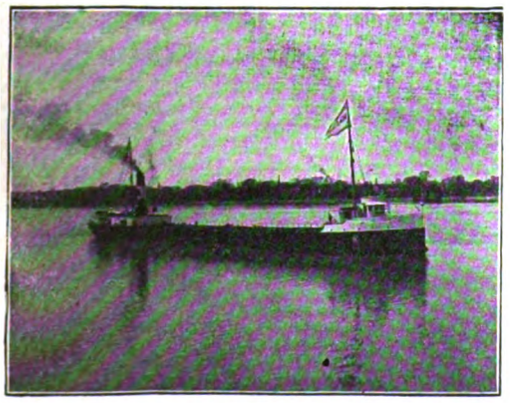
Diamond Flue Blower

the quickest, cheapest and simplest device to rid flues of soot. Installed in the rear of the boiler and operates with the draft. It saves fuel and time. The Northern Steamship Co., of Buffalo (60 blowers)—Gilchrist Transportation Co., Cleveland (110 blowers)—Mitchell & Co., Cleveland 100 blowers, and the Pittsburg Steamship Co., all say they keep the tubes and back heads of the flue sheets clean, and save time and expense. The knowing ones are using it. Are you?

Berlin, Germany

POWER SPECIALTY CO.
500 Washington St., DETROIT, MICH.

Canadian Office
WINDSOR, ONT.



CRAIG SHIP BUILDING CO.

TOLEDO, OHIO.

METAL - AND - WOODEN - SHIP - BUILDERS.

New Dry Dock—525 feet long, 110 feet wide on top, 55 feet wide on bottom, 16 feet of Water on Sill.

Repairs to Metal and Wooden Ships
A SPECIALTY.

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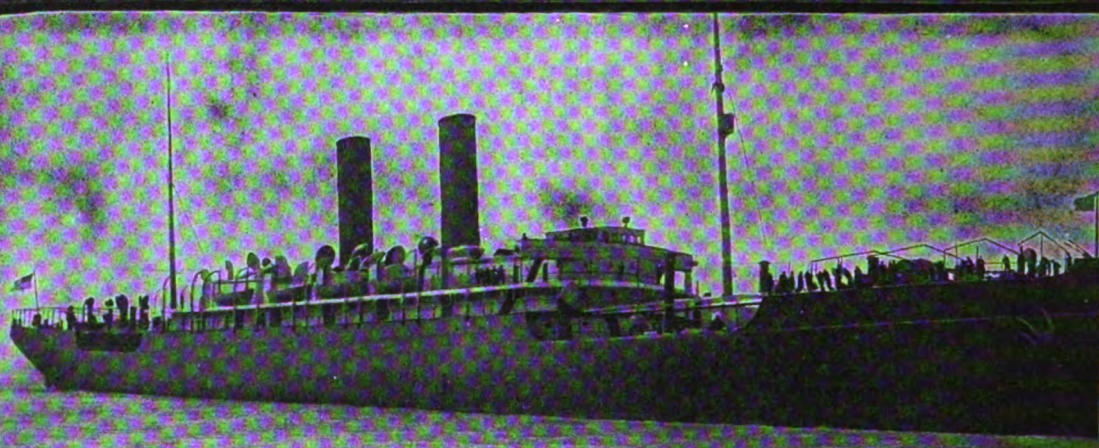
OUR SHIPYARD

WITH ITS ACCOMPANYING DRY DOCKS AND WORKS, WAS CAREFULLY DESIGNED, EQUIPPED AND COMPLETED FOR THE



CONSTRUCTION AND REPAIRING IN EVERY DETAIL OF

BATTLE SHIPS · ARMORED CRUISERS · PROTECTED CRUISERS · GUN BOATS · TORPEDO BOATS · TORPEDO BOAT DESTROYERS · SUBMARINE BOATS · OCEAN LINERS · PASSENGER STEAMERS · FREIGHT CARRIERS · ETC · ETC ·

NEWPORT NEWS SHIPBUILDING & DRY DOCK CO.
1 BROADWAY NEW YORK — NEWPORT NEWS, VA.

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After four years of investigation, the Boiler Committee appointed by the British Admiralty have unanimously declared that water tube boilers are more suitable for Naval purposes than cylindrical, and have again placed THE BABCOCK & WILCOX at the head of all types.

THE BABCOCK & WILCOX CO.

NEW YORK and LONDON

WORKS:

Bayonne, N. J., U. S. A.
Renfrew, Scotland.
Paris, France.
Oberhausson, Germany.

The Only Chain

"as good as"

a Woodhouse Chain is Another Woodhouse Chain.

Seems strange, perhaps, that one firm should excel in making Marine Chains and other chains when the same materials which we use are used by others.

But knowing how has lots to do with it.

And "knowing how" includes more than the mere practical knowledge of chain-making, for it also includes a knowledge of what is required of certain chains—Crane and Dredger Chains, for instance—and how to meet the requirements.

Try us once and see why folks who know swear by the Woodhouse Brand.

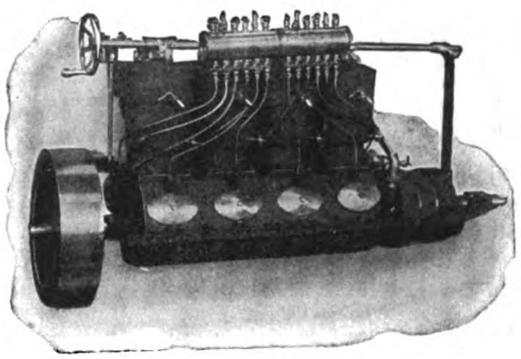
Write us about it anyway.

Woodhouse Chain W'ks,

TRENTON, N. J.

TRUSCOTT

THE DEPENDABLE MARINE MOTOR



Made to withstand the most severe and continuous service. A practical design characterized by the accessibility, compactness and simple ignition, gas producing and oiling features. Perfect control.

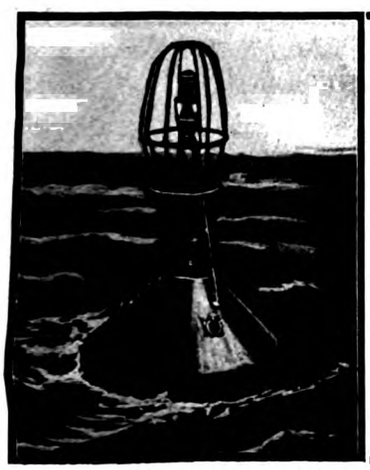
Four cycle type two and four cylinders, from 8 to 65 H. P. Smaller sizes of the two cycle type.

Catalogue and copy of The Launch for the asking.

Department 46.

Truscott Boat Mfg. Co.

ST. JOSEPH, MICHIGAN.



Pintsch Gas Lighted Buoys

BURN CONTINUOUSLY

FROM 80 TO 365 DAYS AND NIGHTS WITHOUT ATTENTION AND CAN BE SEEN AT A DISTANCE OF SIX MILES.

Brilliant & Steady Illumination. Economical & Reliable in Operation.

Adopted by the English, German, French, Russian and United States Light House Departments for Channel and Harbor Lighting; over 1800 gas buoys and gas beacons in service.

Controlled by the

SAFETY CAR HEATING & LIGHTING COMPANY

160 Broadway, NEW YORK CITY.

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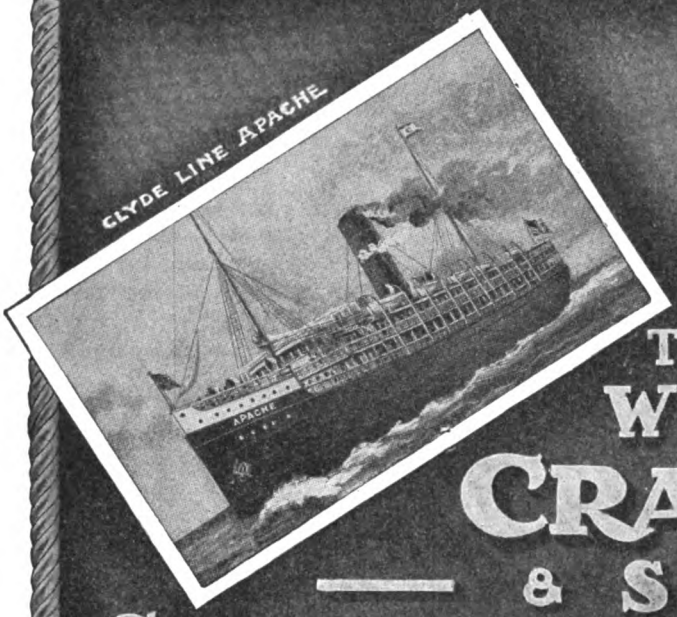
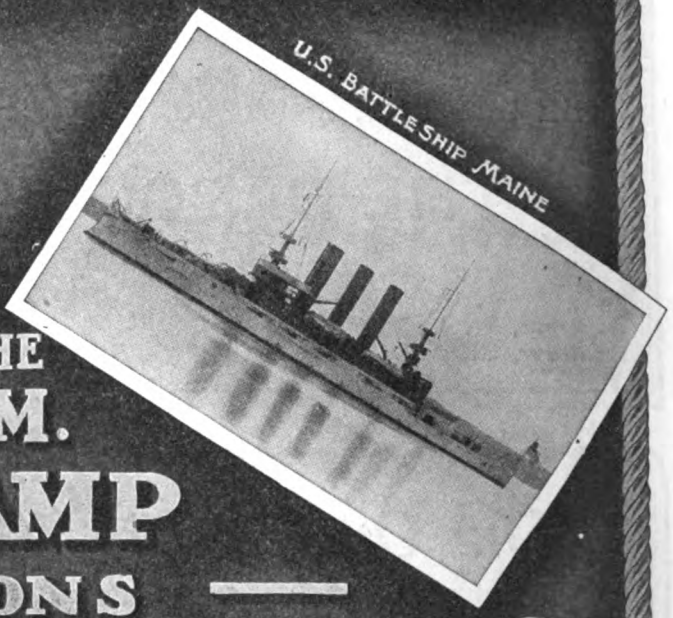


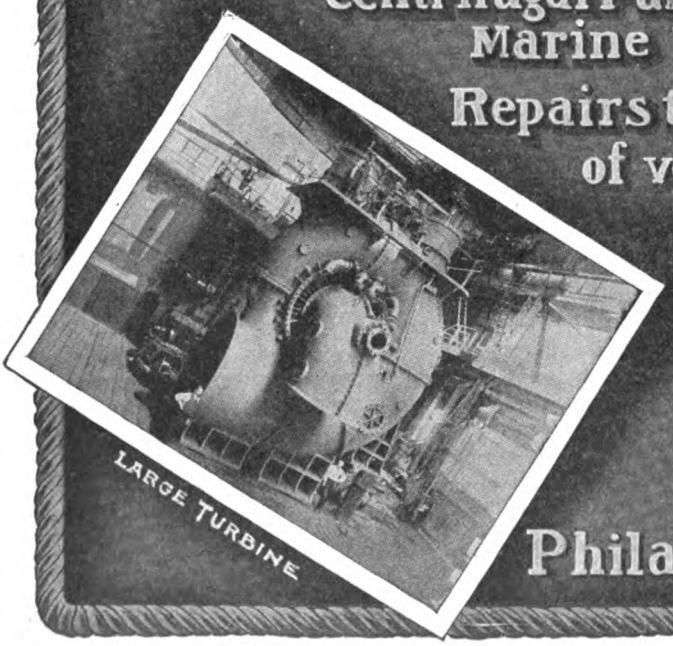


THE
WM.
CRAMP
& SONS
SHIP & ENGINE BUILDING Co.
ESTABLISHED 1830

I.P. MORRIS COMPANY
(ESTABLISHED 1829)

KENSINGTON SHIPYARD Co

WARSHIPS AND MERCHANT STEAMERS
Pumping, Blowing and Hoisting Engines, Dry Docks
Vertical and Horizontal Turbines
Centrifugal Pumping Machinery
Marine Railway.
Repairs to all classes
of vessels



Philadephia

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CLEAN BOILERS

Dearborn Water Treatment made to suit the case. Takes off the scale, keeps it off, stops corrosion and foaming. Send gallon of water for analysis.

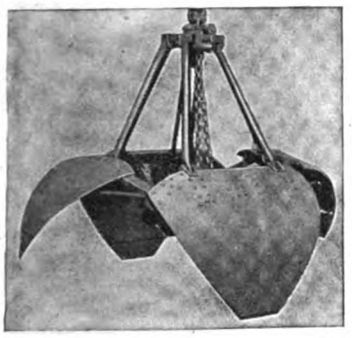
DEARBORN DRUG & CHEMICAL WORKS

G. R. CARR,
Mgr. Marine Dept.

16 BRANCH OFFICES IN THE U. S.

227-234 Postal Telegraph Bldg., CHICAGO.

KIESLER AUTOMATIC BUCKETS



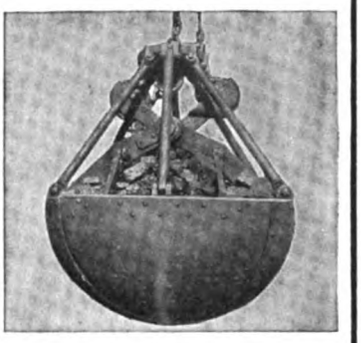
Orange Peel Open

Orange Peel and Clam Shell Types
for handling Coal, Iron Ore and Excavating

We guarantee our Orange Peel to always fill in large lump Soft Coal and Iron Ore. Has two flat lips and will not damage boats or cars. Are from 30 to 50% lighter than any other buckets.
Digging ability due to powerful system of leverage.

Write for Catalogue and Prices.

MAYO & BAILEY 1548 1st Nat'l Bank Bldg. CHICAGO



Orange Peel Closed showing load

THE STANLEY B. SMITH COAL AND DOCK CO.,

TOLEDO HARBOR, TOLEDO, OHIO.

1,800 Feet of Dock. 6 McMyler Derricks. Capacity 3,000 Tons Daily.

Fuel Lighters.—"KANAWHA." —"PENNSYLVANIA." —"HOCKING."

Docks.—PENNSYLVANIA R. R. —HOCKING VALLEY R. R. —TOLEDO AND OHIO CENTRAL R. R.

SMITH'S COAL DOCK, Detroit River, DETROIT, MICH.

12 Pockets. Platform. Low Dock.

Operated by STANLEY B. SMITH & CO.

MARINE SUPPLY COMPANY——STORE AND ICE HOUSE ON DOCK.

PITTSBURG COAL COMPANY

GENERAL OFFICE, LAKE DEPARTMENT, PERRY-PAYNE BUILDING, CLEVELAND, OHIO

Steamboat Fueling Facilities at Various Points on the Great Lakes

CLEVELAND HARBOR { 4 Car Dumpers. 3 Lighters. } FAIRPORT HARBOR { 1 Car Dumper. 1 Lighter. } ERIE HARBOR { 1 Car Dumper. Fuel Pockets.

ASHTABULA HARBOR { 1 Car Dumper. 1 Lighter. } DETROIT RIVER BRANCH { Docks and Pockets at Sandwich and Amherstburg.

SAULT RIVER BRANCHES { Dock and Pockets at Detour. Dock and Pockets at Sault Ste. Marie. (The Port Royal Dock Co.)

WE FURNISH ONLY THE BEST GRADE OF

PITTSBURG AND YOUGHIOGHENY COAL

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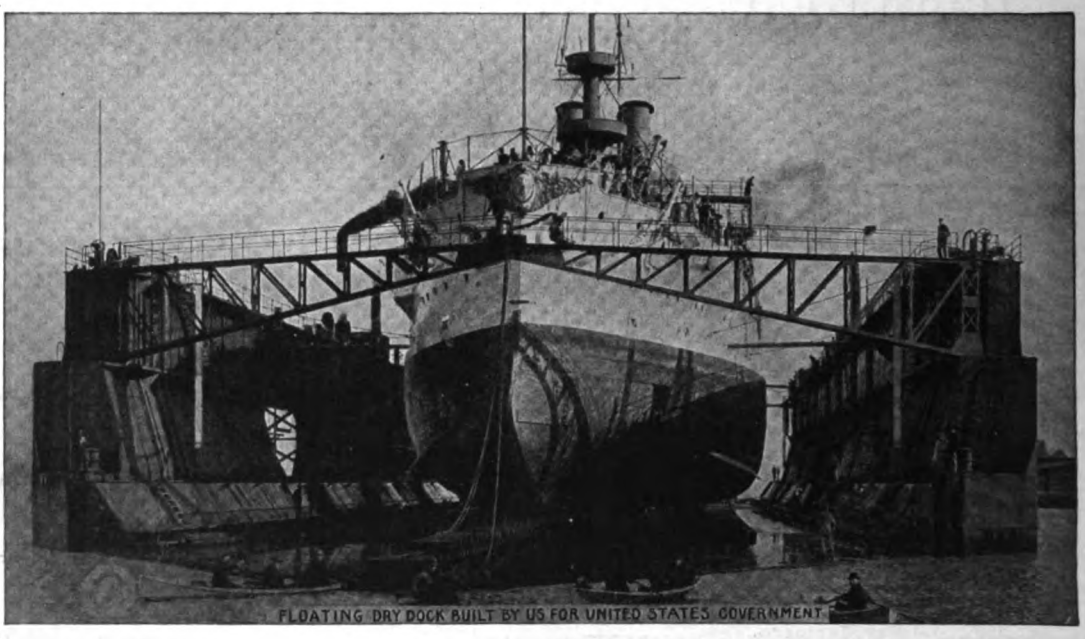
MARYLAND STEEL COMPANY

BUILDERS OF STEEL STEAMSHIPS, TOW BOATS, SAILING VESSELS, BARGES AND STEAM CRAFT OF EVERY DESCRIPTION

STEEL FLOATING DRY DOCKS CAPABLE OF DOCKING THE LARGEST VESSELS



FLOATING DRY DOCK BUILT BY US FOR UNITED STATES GOVERNMENT

SPARROW'S POINT, MARYLAND.

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The MIETZ & WEISS

OIL ENGINES

Two Cycle — Constant Thrust

—Operated by—

Kerosene Oil, Fuel Oil, Distillate or Crude Oil.

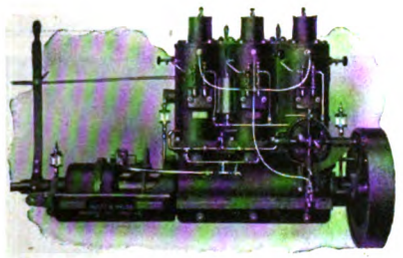
Simplest, Safest, most Reliable and most Economical Engines on the market.

MARINE TYPE.

No Valves, Cams or Gears.
No Electric Sparking Devices.
Automatic Ignition by Compression.
No Dangerous Gasolene used.

STATIONARY TYPE.

Especially adapted for operating electric generators for lighting launches, yachts and house boats. Perfect regulation, greatest economy and absolute safety.



1 to 60 horse power.

See our Exhibit at the Sportsman's Show, Madison Square Garden, Feb. 21 to March 9.

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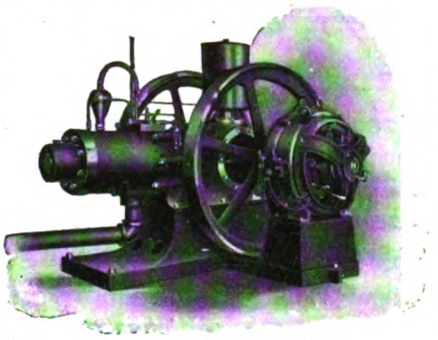


1 to 75 horse power.

AUGUST MIETZ,

Iron Foundry and Machine Works,

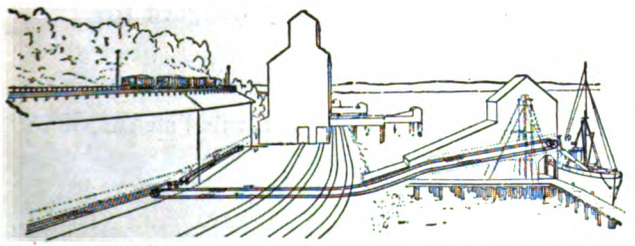
128-138 Mott Street - NEW YORK, U.S.A.

Northern Pacific Railway, Tacoma, Wash. Coal is taken from Bunkers shown at left by Link-Belt Carriers, and delivered into Carrier at right angles running out to sea. This latter Conveyor is carried by hinged Truss. Normal capacity 700 tons per hour.

Ship Loading Plants

We Design and Build

Complete equipments for transporting material of all kinds from cars to vessels or vessels to cars with or without intermediate storage. We have equipped many of the largest transportation companies in the world with machinery of this character whereby the space occupied and the time and labor otherwise consumed in loading and unloading vessels has been greatly reduced. We will submit plans and estimates on request.



Northern Pacific Railway Co., Tacoma, Wash. Loading 700 Tons per Hour

Philadelphia

The Link Belt Engineering Co.

We also Design and Install

Machinery of the highest efficiency for HANDLING MISCELLANEOUS FREIGHT in Steamship Docks and Warehouses.

The Link-Belt Machinery Co.

Engineers, Founders, Machinists. CHICAGO

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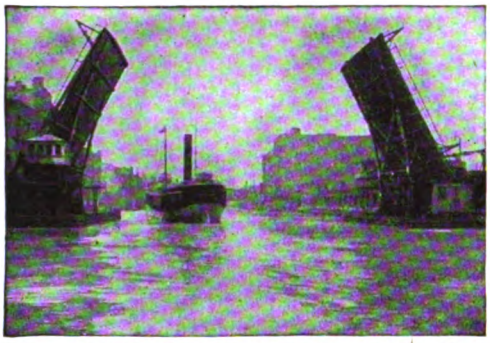


Modern Highway and Electric Railway Scherzer Rolling Lift Bridge open for the passage of large vessel. Superseded and replaced a center pier swing bridge.

More than 60 SCHERZER ROLLING LIFT BRIDGES

have already been built, superseding and replacing swing bridges and other old types of movable bridges for railroads, electric railways and highways in the most progressive cities and harbors of the world.

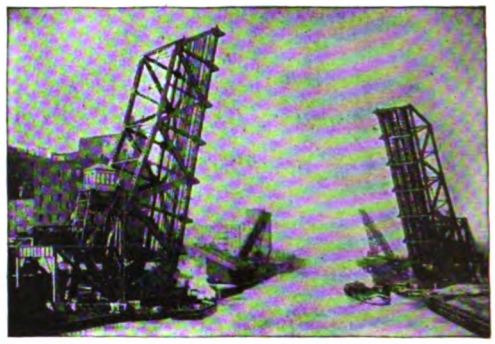
HIGHEST AWARD
World's Fair, St. Louis, 1904

"Center pier swing bridges form **artificial obstructions,** blocking **navigation** and **commerce.** They are condemned, removed and replaced by modern **SCHERZER ROLLING LIFT BRIDGES** wherever **Manufacturing, Commerce, Transportation, Railroads** and **Ships** are valued, protected and advanced."

Write us for photographs, information, sketches and estimates

THE SCHERZER ROLLING LIFT BRIDGE COMPANY

Main Offices: Monadnock Block, Chicago, U. S. A.



Modern Railroad Scherzer Rolling Lift Bridge in the open position. Longest span Bascule Bridge in the world. Also Highway Scherzer Rolling Lift Bridge open further down the river.

"Wiltbonco" Steam Plant Accessories

Awarded Gold Medal at Universal Exposition, St. Louis, 1904.

REFLEX WATER GAUGES AND WILTBONCO GAUGE MOUNTINGS

Used by all the principal Navies of the world, Merchant Marine, and for Locomotives, Automobiles, Stationary and Portable Boilers.

"THE WATER SHOWS BLACK"
ESPECIALLY ADAPTED FOR HIGH PRESSURE.

CUSHION PRESSURE SEATED CONTROL COCKS For all liquids and gases

"FREEPORT" VALVES For all purposes, but particularly designed for high pressures and superheated steam.

"SAFETY" PLASTIC METALLIC PACKING,

COOPERITE SHEET PACKING, For high pressures and superheated steam, acids, ammonia, etc.

WILTBONCO-HOGAN OIL FILTERS.

The Wm. T. Bonner Co.

MERCHANT ENGINEERS, AND MANUFACTURERS

Head Office, 246 Summer St., Boston. New York Sales Office, 141 Broadway

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THE NICLAUSSE BOILER.

The largest merchantmen in the world, the S. S. Minnesota and Dakota, of 33,000 tons and 11,000 H. P. each, are equipped with **Niclausse Boilers.**

641,000 HORSE POWER IN THE NAVIES OF ELEVEN NATIONS.

THE NEW JAPANESE CRUISERS, KATORI AND KASHIMA, OF 16,000 H. P. EACH, AND IN THE UNITED STATES NAVY THE ARMORED CRUISERS PENNSYLVANIA AND COLORADO, 23,000 H. P. EACH, AND THE BATTLESHIPS GEORGIA AND VIRGINIA, 19,000 H. P. EACH, WILL BE FITTED WITH THESE BOILERS.

THE ONLY WATER-TUBE BOILER SUCCESSFULLY USED AND PROVED IN LARGE SHIPS.

Requires no space at sides or rear—cleaned from the front.
Employs no tube-caps—tubes can readily be withdrawn without mutilation.
FORGED STEEL THROUGHOUT.

THE STIRLING COMPANY, General Offices, Trinity Building, NEW YORK.

THE ROBERTS
SAFETY WATER-TUBE
BOILER CO.

Manufacturers of High Grade

Marine Water Tube Boilers

Generators of the Highest Quality of Steam

NEARLY 1500 IN USE

Send for circulars and stock sheet

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Phone 599 Cortlandt

Works: Red Bank, N. J.
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Cable Address
"Bruniva"

LUNKENHEIMER
"CLIP" GATE VALVES

Iron Body Brass Mounted or All Iron.
Screw or Flange Ends.
For 100 Pounds Pressure.
Wedge Disc Double Seated.
Will take pressure from either end.
Can be packed under pressure.

Notify us if your local dealer cannot furnish them.

The Lunkenheimer Co.,
CINCINNATI, OHIO, U. S. A.

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35 Great Dover St., London.

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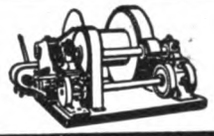

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Suitable for all Boats from 3½ to 200 H.P.
Over 100 in successful use.
Also the well known and always reliable Wootters Gas or Gasolene Stationary Engines.

HOISTING ENGINES
Of all kinds and sizes, and for all purposes, especially for ship use.
Docking and Hauling Engines and Wire Rope Windlasses.

AUTOMATIC TOWING MACHINES
Somewhat the cheapest, and altogether the best. Positively guaranteed.
Automatic Fog Whistle Machines
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FOR THESE AND OTHER WELL KNOWN SPECIALTIES ADDRESS ALL INQUIRIES TO.

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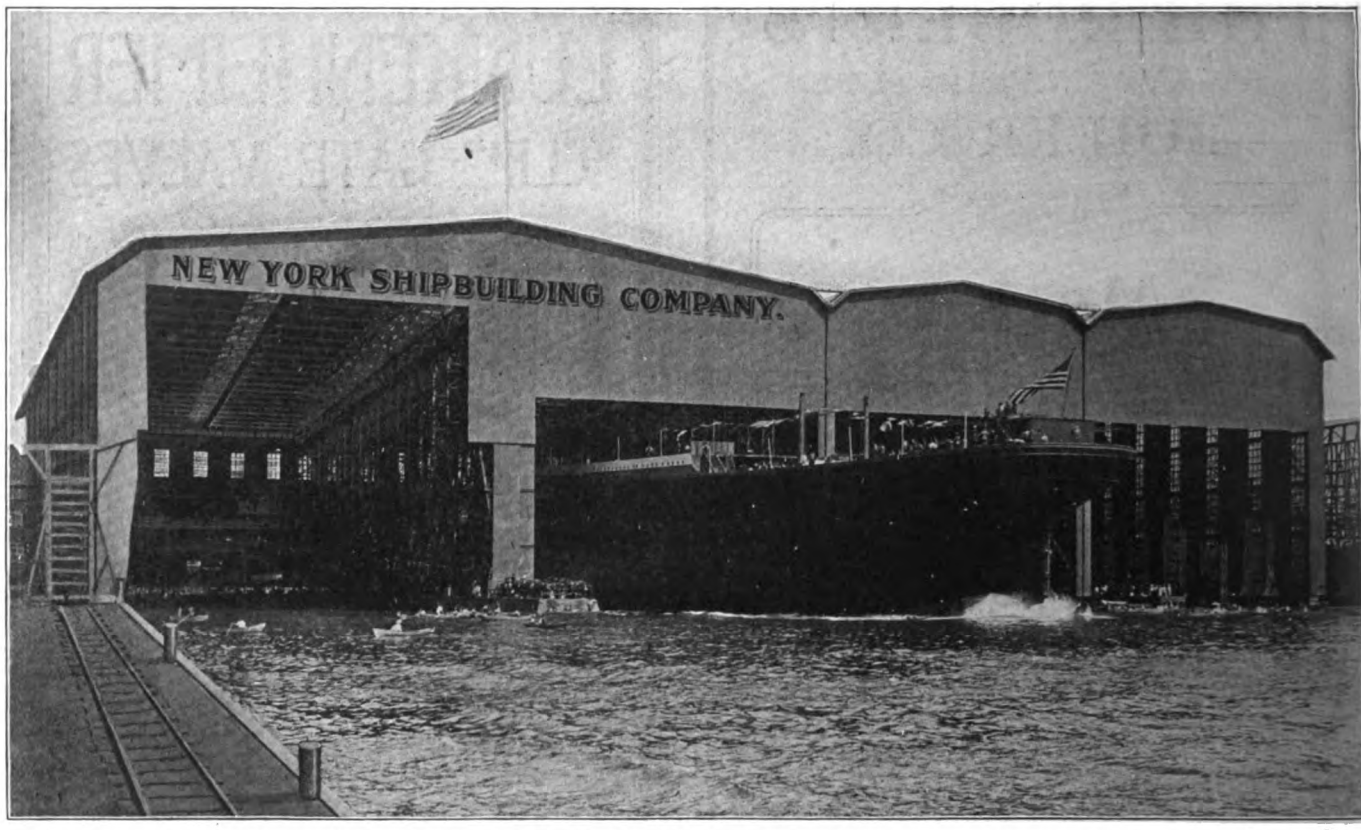
Builders of

SHIPS — ENGINES — BOILERS
HEAVY MACHINERY



Launch of "Mongolia," Pacific Mail S. S. Co., July 25, 1903.
615 feet long, 65 feet beam, 51 feet deep.

Best Facilities for Repair Work

Pneumatic and Electric Tools;
ample wharfage accomodation.

100 ton crane.

Repairs done under shelter.

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who are broad in their views and opinions and progressive in spirit, are always looking for

SOMETHING BETTER

and that is the reason for the steadily increasing popularity of

DEARING WATER TUBE BOILERS

They are the acknowledged **"PERFECTION OF THE WATER TUBE SYSTEM."**

Dearing Water Tube Boiler Co., DETROIT, MICHIGAN.

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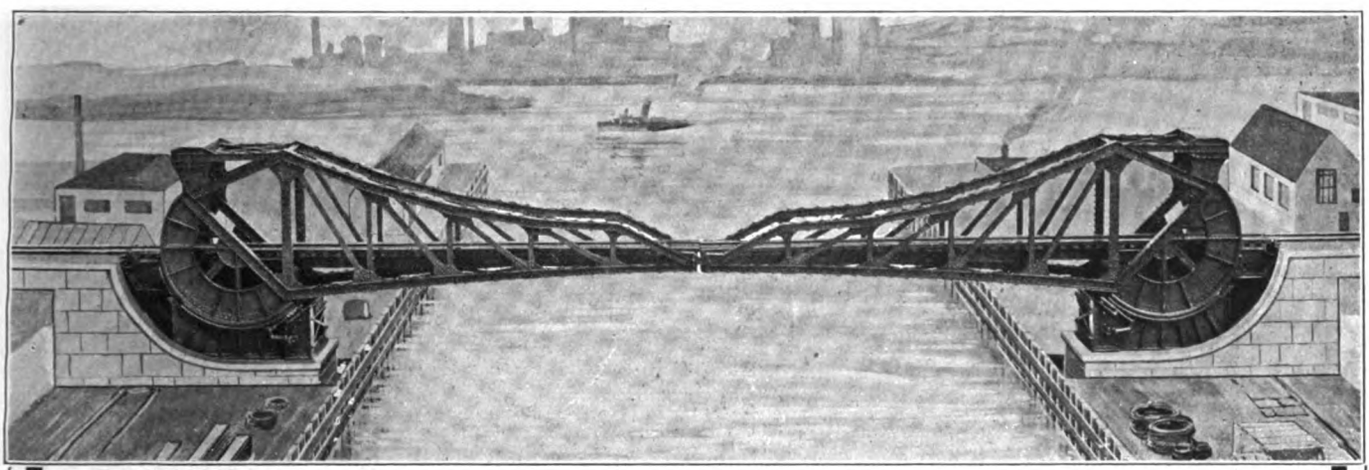

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The Cowing Bridge represents the most modern type of Lift Bridge.

Highest Award at St. Louis, Mo. 1904.

Plans and estimates promptly furnished.

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DETROIT, MICH.

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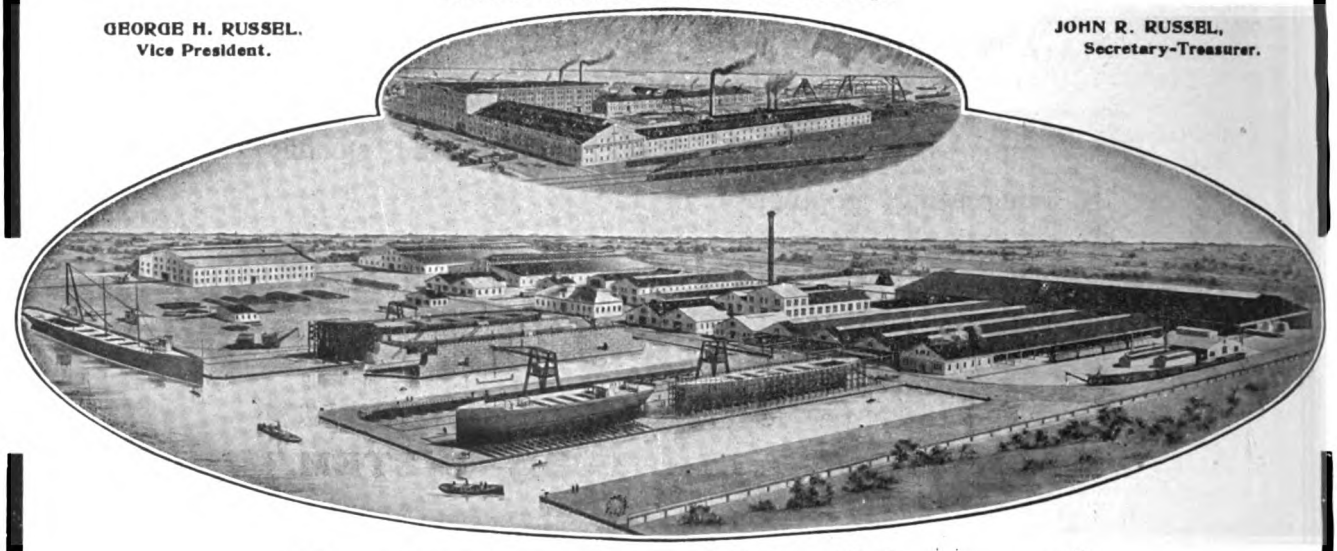

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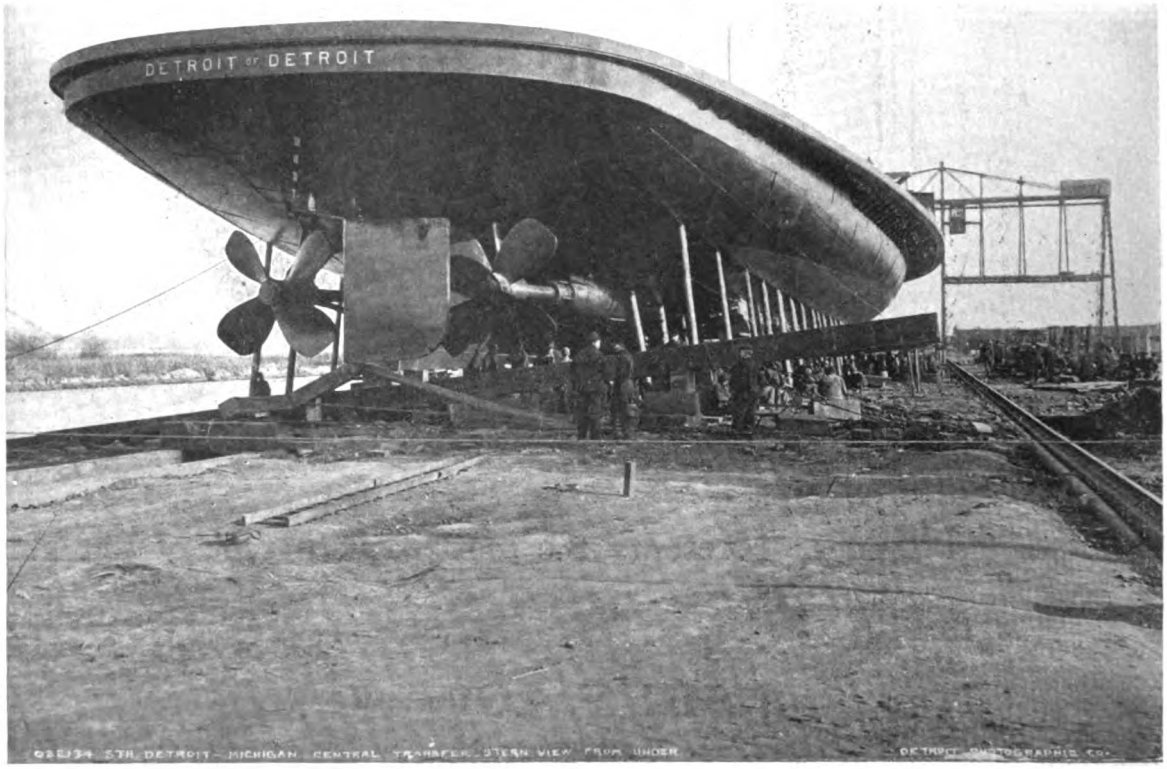

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English Royal Navy	966,300 "
Russian Imperial Navy	253,800 "
Japanese Imperial Navy	122,700 "
Austrian Imperial Navy	56,700 "
Italian Royal Navy	32,500 "
Chilian Navy	26,500 "
Argentine Navy	13,000 "
The "Messageries Maritimes" Company	87,600 "
Chemins de fer de l'Ouest: (The French Western Railway Co.) Steamships plying between Dieppe and Newhaven	18,500 "
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CAPITAL: 6,000,000 FRANCS

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give highest efficiency and durability. Specify them and get the best.

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A complete assortment of Angles, Beams, Channels, Plates, Etc.—cut to length if desired.

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Buyers' Directory of the Marine Trade

For a more complete classification than that represented by advertisers in the Marine Review, see the BLUE BOOK OF AMERICAN SHIPPING, marine and naval directory of the United States, published by The Marine Review, Cleveland.

See accompanying index of Advertisers for full addresses of concerns in this directory.

AIR COMPRESSORS, AIR HOISTS, ETC.
Great Lakes Engineering Works.....Detroit.
Mietz, Aug. .....New York.

AIR PORTS, DEAD LIGHTS, ETC.
Marine Mfg. & Supply Co.....New York.

AIR PUMPS AND APPLIANCES.
Fore River Ship & Engine Co..Quincy, Mass.
Great Lakes Engineering Works.....Detroit.

ANCHORS.
Bowers, L. M. & Co.....Binghamton, N. Y.
Seaboard Steel Casting Co.....Chester, Pa.

ANTI-FOULING AND ANTI-CORROSIVE COMPOSITION FOR STEEL VESSELS.
Holzapfel's American Composition Co.... .....New York.

ANTI-FRICTION METALS.
Cramp, Wm. & Sons.....Philadelphia.

ARTIFICIAL DRAFT FOR BOILERS.
American Ship Building Co.....Cleveland.
Detroit Ship Building Co.....Detroit
Great Lakes Engineering Works.....Detroit
Sturtevant, B. F., Co.....Hyde Park, Mass.

ASH EJECTORS.
Great Lakes Engineering Works.....Detroit.

ATTORNEYS AND PROCTORS IN ADMIRALTY.
Gilchrist, Albert J.....Cleveland.
Goulder, Holding & Masten.....Cleveland.
Hoyt, Dustin & Kelley.....Cleveland.
Kremer, C. E.....Chicago.
MacDonald, Ray G.....Chicago.
Potter & Potter.....Buffalo.
Shaw, Warren, Cady & Oakes.....Detroit.
White, Johnson, McCaslin & Cannon Cleveland

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Ritchie, E. S. & Sons.....Brookline, Mass.

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Link Belt Machinery Co.....Chicago.

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Cleveland Block Co.....Cleveland.

BLOWERS.
Power Specialty Co.....Detroit.
Sturtevant, B. F. Co.....Hyde Park, Mass.

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Drein, Thos. & Son.....Wilmington, Del.
Kahnweiler's Sons, David.....New York.
Lane & DeGroot....Long Island City, N. Y.
Marine Construction & D. D. Co..... .....Mariner's Harbor, S. I., N. Y.
Truscott Boat Mfg. Co.....St. Joseph, Mich.
Willard, Chas. P. & Co. Winthrop Harbor, Ill.

BOILER CLEANING DEVICE.
Power Specialty Co.....Detroit.

BOILER COMPOUNDS.
Dearborn Drug & Chemical Works....Chicago.

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Almy Water Tube Boiler Co..Providence, R. I.
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Atlantic Works.....East Boston, Mass.
Babcock & Wilcox Co.....New York.
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Chicago Ship Building Co.....Chicago.
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Dearing Water Tube Boiler Co.....Detroit.
Delauney, Belleville & Co...St. Denis, France.
Detroit Ship Building Co.....Detroit.
Fletcher, W. A. & Co.....Hoboken, N. J.
Fore River Shipbuilding Co.....Quincy, Mass.
Georgian Bay Engineering Works..... .....Midland, Ont.
Great Lakes Engineering Works.....Detroit.
Kingsford Foundry & Machine Works.... .....Oswego, N. Y.
Marine Iron Works.....Chicago.

BOILER MANUFACTURERS—Continued.
Maryland Steel Co.....Sparrows Point, Md.
Milwaukee Dry Dock Co.....Milwaukee.
Mosher Water Tube Boiler Co....New York.
Newport News Ship Building Co..... .....Newport News, Va.
New York Shipbuilding Co.....Camden, N. J.
Northwestern Steam Boiler & Mfg. Co.... .....Duluth, Minn.
Roberts Safety Water Tube Boiler Co.... .....New York.
Stirling, The Co..... New York.
Superior Ship Building Co.....Superior, Wis.
Taylor Water Tube Boiler Co.....Detroit.
Willard, Chas. P. & Co..Winthrop Harbor, Ill.

BOILER RIVETS.
Bourne-Fuller Co.....Cleveland.

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Lunkenheimer Co.....Cincinnati.
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Scherzer Rolling Lift Bridge Co.....Chicago.

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Brown Hoisting & Conveying Machine Co. ..... Cleveland.
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Mayo & Bailey .....Chicago.

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Upson-Walton Co.....Cleveland.

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Hyde Windlass Co.....Bath, Me.
Marine Mfg. & Supply Co.....New York.

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Woodhouse Chain Works.....Trenton, N. J.

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General Electric Co.....Schenectady, N. Y.

CHAIN HOISTS.
Boston & Lockport Block Co....Boston, Mass.

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Penton Publishing Co.....Cleveland.
Potter, J. D.....London.

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Ironville Dock & Coal Co.....Toledo, O.
Pickands, Mather & Co.....Cleveland.
Pittsburg Coal Co.....Cleveland.

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Dunbar & Sullivan Dredging Co.....Buffalo.
Fitz-Simons & Connell Co.....Chicago.
Hickler Bros.....Sault Ste. Marie, Mich.
Lake Superior Contracting & Dredging Co., ... Duluth, Minn.
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Starke Dredge & Dock Co., C. H..Milwaukee.
Sullivan, M.....Detroit.

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Baker & Co., H. H.....Buffalo
Upson-Walton Co.....Cleveland.

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Armstrong Cork Co.....Pittsburg, Pa.
Kahnweiler's Sons, D.....New York.

CRANES, TRAVELING.
Brown Hoisting Machinery Co.....Cleveland.
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Schrader's Son, A.....New York

DREDGING CONTRACTORS.
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Buffalo Dredging Co.....Buffalo.
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Starke Dredge & Dock Co., C. H..Milwaukee.
Sullivan, M.....Detroit

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DRY DOCKS.
American Ship Building Co.....Cleveland
Atlantic Works.....East Boston, Mass.
Buffalo Dry Dock Co.....Buffalo
Chicago Ship Building Co.....Chicago
Craig Ship Building Co.....Toledo, O.
Cramp, Wm. & Sons.....Philadelphia
Detroit Ship Building Co.....Detroit
Great Lakes Engineering Works.....Detroit
Lockwood Mfg. Co.....East Boston, Mass.
Milwaukee Dry Dock Co.....Milwaukee
Newport News Ship Building Co..... .....Newport News, Va.
Shipowners Dry Dock Co.....Chicago
Superior Ship Building Co....Superior, Wis.

ELECTRIC HOISTS AND CRANES.
General Electric Co.....Schenectady, N. Y.

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General Electric Co.....Schenectady, N. Y.
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WANTED and FOR SALE Department.

PROPOSALS.

U. S. Engineer Office, Milwaukee, Wis., April 15, 1905.—Sealed proposals for dredging Gladstone Harbor, Mich., concrete superstructure on Breakwater and on North Harbor Pier, Milwaukee, Wis., and removing old piers and building pile piers and timber superstructure, Waukegan Harbor, Ill., will be received here until 3 P. M., standard time, May 16, 1905, and then publicly opened. Information furnished on application. J. G. Warren, Major Engrs. may 11

PROPOSALS FOR RECONSTRUCTING PIER.—U. S. Engineer Office, 262 Huron Street, Cleveland, O., April 17th, 1905. Sealed proposals for reconstructing and repairing parts of the West Pier at Lorain Harbor, Ohio, will be received at this office until 2 P. M. May 19th, 1905, and then publicly opened. Specifications, blank forms, and all available information will be furnished on application to this office. DAN C. KINGMAN, Lieut. Col. Corps of Engineers, U. S. A. may 11

PROPOSALS FOR DREDGING.—U. S. Engineer Office, 262 Huron Street, Cleveland, O., April 19, 1905. Sealed proposals for improving Cleveland Harbor, Ohio, by dredging, will be received at this office until 2 P. M., May 22d, 1905, and then publicly opened. Specifications, blank forms and all available information will be furnished on application to this office. DAN. C. KINGMAN, Lieut. Col. Corps of Engineers, U. S. A. May 18

U. S. Engineer Office, Buffalo, N. Y., April 29, 1905.—Sealed proposals for construction of stone superstructure and sea slope, and for stone riprap, on South Harbor section of Buffalo breakwater, will be received here until 11 a. m. May 29, 1905, and then opened. Information furnished on application. H. M. Adams, Lieut. Col. Engrs. May 25

U. S. Engineer Office, Buffalo, N. Y. April 26, 1905. Sealed proposals for dredging in Buffalo River Entrance Channel will be received here until 11 A. M., May 26, 1905, and then opened. Information furnished on application. H. M. Adams, Lieut. Col. Engrs. May 18

U. S. Engineer Office, Buffalo, N. Y., April 22, 1905. Sealed proposals for extending south pier and placing concrete superstructure on north pier at Erie, Pa., will be received here until 11 A. M., May 22, 1905, and then opened. Information furnished on application. H. M. Adams, Lieut. Col. Engrs. May 18

U. S. Engineer Office, Galveston, Tex., May 1, 1905.—Sealed proposals, in triplicate, for suction dredge, will be received here until 12 m., May 31, 1905, and then publicly opened. Informaiton furnished on application. Edgar Jadwin, Capt., Engrs. May 25

U. S. Engineer Office, Buffalo, N. Y., April 15, 1905.—Sealed proposals for channel and basin excavation at Erie Harbor, Pa., will be received here until 11 A. M. May 15, 1905, and then opened. Information furnished on application.—H. M. Adams, Lieut. Col. Eng'rs. may 11

U. S. Engineer Office, Duluth, Minn., April 13, 1905.—Sealed proposals for furnishing and placing about 53,000 tons of riprap at Ashland, Wis., will be received here until noon, May 13, 1905, and then publicly opened. Information on application. Chas. L. Potter, Major Engrs. may 11

U. S. Engineer Office, Room 508 Federal Bldg., Chicago, Ill., April 15, 1905.—Sealed proposals for rock excavation in Calumet River, Ill., will be received here until noon May 15, 1905, and then publicly opened. Information on application. Wm. H. Bixby, Lieut. Col. Engrs. may 11

U. S. ENGINEER OFFICE.—Grand Rapids, Mich., May 3, 1905. Sealed proposals for Excavating new channel from Kalamazoo River to Lake Michigan will be received here until 3 p. m., June 2, 1905, and then publicly opened. Information furnished on application. M. B. ADAMS, Col., Eng'rs. May 25

PROPOSALS.

U. S. Engineer Office, Buffalo, N. Y., April 13, 1905.—Sealed proposals for concrete superstructure on south pier, Buffalo, N. Y., will be received here until 11 A. M. May 13, 1905, and then opened. Information furnished on application.—H. M. Adams, Lieut. Col. Eng'rs. may 11

U. S. ENGINEER OFFICE, Buffalo, N. Y., April 20, 1905.—Sealed proposals for breakwater extension at Cape Vincent, N. Y. will be received here until 11 A.M. May 20, 1905 and then opened. Information furnished on application. H. M. Adams, Lieut. Col. Eng'rs. may 18

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Patent on Valuable Nautical Invention.

A device in the form of an air buoy for definitely locating sunken vessels. Should the vessel sink upon which this buoy is placed, the buoy floats, and a line, made fast in a separate compartment, unreels until the vessel strikes bottom, thereby locating the exact position of the sunken vessel. This buoy is also adapted for use as a mooring buoy for yachts of all sizes, and for all floating property. It can be manufactured and sold for much less than any other buoy in use. Will sell the patent for cash or exchange for vessel or other property. Address, Capt. J. Fred Tribble, 59 Broadway, Norwich, Conn. t.f.

Tug Wm. Engel.

A first class fishing rig for sale. Tug suitable for fishing or towing. For further information write to Thomas Mader, 81 Middle St., Kenosha, Wis. t.f

Dredging Outfits for Sale.

Two dipper dredges one partly burned; two combination dipper and clam shell dredges; four tugs; dump scows; flat scows; dredging appliances. Complete business to be closed out. For particulars address Carkin, Stickney & Cram, Detroit. May 25

Lake Tug for Sale.

Tug Kate Williams—rebuilt 1901, rates 1½. Moored Manitowoc, Wis., where she may be inspected. For prices and terms address Lake Shore Stone Co., Milwaukee, Wis. May 25

For Sale.

Ten shares of stock of Manitowoc Dry Dock Company, Manitowoc, Wis. Address Box 80, Marine Review. t. f.

The Steamer Gordon Campbell.

Burned on spar-deck—easy to cut down to lumber barge, to carry million feet. Machinery and boilers untouched. Hull untouched and in good condition. Boat in dry dock and thoroughly overhauled last summer. Can be seen in Chicago. Want best offer. Simon Kruse, Attorney, Ashland Block, Chicago. t. f.

FOR SALE.

Motor Boat For Sale.

On the St. Lawrence river: A specially built motor boat, 32x6, fitted with a double cylinder, 14 horse motor. A remarkably beautiful and excellent boat, but as the owner thinks it too small for his use, will sacrifice so as to build a larger one. Big bargain for some one. It is almost finished. Do not overlook this. I have dozens of other hulls in stock, all sizes, all prices, or will build to order anything you want. Henry E. Francis, Jr., Alexandria Bay, N. Y. t.f

FOR SALE.

Steam Yacht Cygnet

35 ft. over all; 7 ft. beam. Has electric light and keel condenser. Burns oil for fuel. In fine order.

J. L. ALBERGER,
Ellicott Square, - BUFFALO, N. Y.
May 4

Tug Jim Pullar and Scow.

Tug—built in 1894; 61 ft. long; 15 ft. beam. Water tube boiler. Compound condensing engine. Strong and seaworthy.

Scow—five years old. Excellent construction; 132 ft. long; 29½ ft. wide at center, 26 ft. wide at ends. Platform style, with stake pockets.

Tug and Scow recently overhauled and are in good condition. May be seen at Washburn, Wis., dock.

Address, Fowler-Jacobs Co., Fisher Building, Chicago. t.f.

Lighter for Sale.

Lighter Ann Walker. Hull 93 x 20 x 9. House 79 x 18 x 8. Reason for selling, owner has no further use for her. Address Mutual Transit Co., Buffalo, N.Y. May 18

WANTED.

Tug Wanted.

Wanted, a good second-hand tug boat, 35 to 50 ft. in length, not over 13 ft. beam amidships, about 5 ft. draft. Hull particularly to be in first class condition. Address the Wolverine Portland Cement Co., Coldwater, Mich. May 11.

Tug Wanted.

Tug 50 ft. long, 13 ft. beam, 6 ft. depth, with 12 x 14 engine. State age of boiler and hull. Address Marine, 99 Northampton street, Buffalo, N. Y.

May 4

Salesmen Wanted.

Wanted.—Salesmen or agents to sell a patented specialty of great merit for boilers, which is already being used by the largest concerns. Address Power Specialty Co., 513 Washington Arcade, Detroit, Mich. t.f.

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Bertram Engine Works Co., Ltd.....
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Chicago Ship Building Co.....Chicago.
Chase Machine Co.....Cleveland.
Cramp, Wm. & Sons.....Philadelphia.
Craig Ship Building Co.....Toledo, O.
Dake Engine Co.....Grand Haven, Mich.
Detroit Ship Building Co.....Detroit.
Fletcher, W. & A. Co.....Hoboken, N. J.
Fore River Shipbuilding Co....Quincy, Mass.
Great Lakes Engineering Works.Detroit, Mich.
Hall Bros. .....Philadelphia.
Lockwood Mfg. Co.....East Boston, Mass.
Marine Iron Works.....Chicago.
Maryland Steel Co.....Sparrows Point, Md.
Mietz, Aug.....New York.
Milwaukee Dry Dock Co.....Milwaukee.
Mosher, Chas. D.....New York.
Moulton Steering Engine Co.....New York.
Newport News Ship Building Co.....
.....Newport News, Va.
New York Shipbuilding Co....Camden, N. J.
Northwestern Steam Boiler & Mfg. Co...
..... Duluth, Mich.
Roach's Ship Yard.....Chester, Pa.
Sheriffs Mfg. Co.....Milwaukee.
Superior Ship Building Co....Superior, Wis.
Thropp, J. E. & Sons Co.....Trenton, N. J.
Trout, H. C.....Buffalo.
Willard, Chas. P. & Co..Winthrop Harbor, Ill.

ENGINE ROOM TELEGRAPH, CALL BELLS, ETC.

Cory, Chas. & Son.....New York.
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ENGINE TESTING.

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Crane Co. .....Chicago.
Kieley & Mueller .....New York.
Lunkenheimer Co. .....Cincinnati.
New York Belting & Packing Co..New York.
Northwestern Steam Boiler & Mfg. Co..
..... Duluth, Minn.

ENGINEERS, MARINE, MECHANICAL, CONSULTING.

Hynd, Alexander .....Cleveland.
Hunt, Robt. W. & Co.....Chicago.
Kidd, Joseph.....Duluth, Minn.
Kreer & Parsons.....Chicago.
Lovejoy, H. O.....Buffalo.
Mosher, Chas. D.....New York.
Nacey, James .....Cleveland.
Rice, Henry .....Buffalo.
Roelker, H. B. .....New York.
Wood, W. J. .....Chicago.

FANS FOR VENTILATION, EXHAUST, ETC.

Sturtevant, B. F. Co.....Hyde Park, Mass.

FEED WATER PURIFIERS AND HEATERS.

Greacen-Derby Engineering Co.....
.....Perth Amboy, N. J.
Ross Valve Co.....Troy, N. Y.

FIXTURES FOR LAMPS, OIL OR ELECTRIC.

General Electric Co.....Schenectady, N. Y.

FORGES.

Sturtevant, B. F. Co.....Boston.

FORGINGS FOR CRANK, PROPELLER OR THRUST SHAFTS, ETC.

Cleveland City Forge & Iron Co...Cleveland.
Fore River Shipbuilding Co.....Quincy, Mass.
Macbeth Iron Co.....Cleveland.

FLUE WELDING.

Fix's, S. Sons.....Cleveland.

FUEL ECONOMIZERS.

Sturtevant Co., B. F.....Hyde Park, Mass.

FUELING COMPANIES AND COAL DEALERS.

Hanna, M. A. & Co.....Cleveland.
Ironville Dock & Coal Co.....Toledo, O.
Parker Bros. Co., Ltd.....Detroit.
Pickands, Mather & Co.....Cleveland.
Pittsburg Coal Co.....Cleveland.
Smith, Stanley B., & Co.....Detroit.
Smith Coal & Dock Co., Stanley B. Toledo, O.

FUELING PLANTS, BUILDERS OF

Link Belt Machinery Co.....Chicago.

FURNACES FOR BOILERS.

Continental Iron Works.....New York.

GAS BUOYS.

Safety Car Heating & Lighting Co..New York.

GAS AND GASOLINE ENGINES.

Chase Machine Co.....Cleveland.
Georgian Bay Engineering Works.....
.....Midland, Ont.

GAUGES, STEAM AND VACUUM.

Ashton Valve Co.....Boston.
Lunkenheimer Co. .....Cincinnati.

GAUGES, WATER.

Bonner & Co., Wm. T.....Boston.
Lunkenheimer Co. .....Cincinnati, O.

GRAPHITE.

Dixon Crucible Co., Joseph..Jersey City, N. J

GREASE EXTRACTORS.

Greacen-Derby Engineering Co.....
.....Perth Amboy, N. J.

HAMMERS, STEAM.

Chase Machine Co.....Cleveland.

HEATING APPARATUS.

Sturtevant, B. F. Co.....Hyde Park, Mass.

HOISTS FOR CARGO, ETC.

American Ship Building Co.....Cleveland.
Brown Hoisting Machinery Co. (Inc.).....
..... Cleveland.
Chase Machine Co.....Cleveland.
General Electric Co.....New York.
Georgian Bay Engineering Works.....
.....Midland, Ont.
Hyde Windlass Co.....Bath, Me.
McMyler Mfg. Co.....Cleveland.
Marine Iron Co.....Bay City.
Mietz, Aug. .....New York.

HOLLOW STAYBOLT IRON.

Falls Hollow Staybolt Co...Cuyahoga Falls, O.

HOSE, RUBBER.

New York Belting & Packing Co..New York.

HYDRAULIC DREDGES.

Great Lakes Engineering Works.....Detroit.

HYDRAULIC TOOLS.

Watson-Stillman Co., The.....New York.

ICE MACHINERY.

Great Lakes Engineering Works.....Detroit.
Roelker, H. B.....New York.

INDICATORS FOR STEAM ENGINES.

Ashton Valve Co.....Boston.

INJECTORS.

American Injector Co.....Detroit.
Crane Co. .....Chicago.
Jenkins Bros. .....New York.
Lunkenheimer Co.....Cincinnati.
Penberthy Injector Co.....Detroit, Mich.

INSURANCE, MARINE.

Elphicke, C. W. & Co.....Chicago.
Fleming & Co., E. J.....Chicago.
Gilchrist & Co., C. P.....Cleveland.
Hawgood & Co., W. A.....Cleveland.
Helm & Co., D. T.....Duluth.
Hutchinson & Co.....Cleveland.
McCarthy, T. R.....Montreal.
McCurdy, Geo. L.....Chicago.
Mitchell & Co.....Cleveland.
Parker Bros. Co., Ltd.....Detroit.
Peck, Chas. E. & W. F..New York & Chicago.
Prindiville & Co.....Chicago.
Richardson, W. C.....Cleveland.
Sullivan, D. & Co.....Chicago.

IRON ORE AND PIG IRON.

Bourne-Fuller Co.....Cleveland, O.
Hanna, M. A. & Co.....Cleveland.
Pickands, Mather & Co.....Cleveland.

LAUNCHES—STEAM, NAPHTHA, ELECTRIC.

Georgian Bay Engineering Works.....
.....Midland, Ont.
Marine Iron Works.....Chicago.
Truscott Boat Mfg. Co.....St. Joseph, Mich.
Willard, Chas. P.....Winthrop Harbor, Ill.

LIFE PRESERVERS, LIFE BOATS, BUOYS.

Armstrong, Cork Co.....Pittsburg.
Drein, Thos. & Son.....Wilmington, Del.
Gaynor, T. F .....New York.
Kahnweiler's Sons, D.....New York.
National Cork Co.....Brooklyn.

LIGHTS, SIDE AND SIGNAL.

Russell & Watson .....Buffalo.

LOGS.

Nicholson Ship Log Co.....Cleveland.
Walker & Sons, Thomas....Birmingham, Eng.
Also Ship Chandlers.

LUBRICATING GRAPHITE.

Dixon Crucible Co., Joseph..Jersey City, N. J.

LUBRICATORS.

Crane Co.....Chicago.
Lunkenheimer Co. .....Cincinnati.

LUMBER.

Martin-Barriss Co.....Cleveland.

MACHINISTS.

Chase Machine Co.....Cleveland.
Hickler Bros.....Sault Ste. Marie, Mich.
Lockwood Mfg. Co.....East Boston, Mass.

MACHINE TOOLS (WOOD WORKING).

Atlantic Works, Inc.....Philadelphia.

MARINE RAILWAYS.

Hickler Bros.....Sault Ste. Marie, Mich.

MARINE RAILWAYS, BUILDERS OF.

Crandall & Son, H. I.....East Boston, Mass.

MATTRESSES, CUSHIONS, BEDDING.

Fogg, M. W.....New York.

MECHANICAL DRAFT FOR BOILERS.

American Ship Building Co.....Cleveland.
Detroit Ship Building Co.....Detroit.
Great Lakes Engineering Works.....Detroit.
Sturtevant, B. F. Co.....Hyde Park, Mass.

METALLIC PACKING.

Katzenstein, L. & Co.....New York.

METAL POLISH.

Bertram's Oil Polish Co.....Boston.

MOTORS, GENERATORS—ELECTRIC.

Fisher Electrical Works.....Detroit.
General Electric Co.....Schenectady, N. Y.
Sturtevant, B. F. Co.....Hyde Park, Mass.

NAUTICAL INSTRUMENTS.

Ritchie, E. S., & Sons.....Brookline, Mass.

NAVAL ARCHITECTS.

Hynd, Alexander .....Cleveland.
Kidd, Joseph .....Duluth, Minn.
Kreer & Parsons.....Chicago.
Lovejoy, H. O. .....Buffalo.
Matteson & Drake.....Philadelphia.
Mosher, Chas. D.....New York.
Nacey, James .....Cleveland.
Rice, Henry .....Buffalo.
Wood, W. J. .....Chicago.

OAKUM.

Stratford, Oakum Co.....Jersey City, N. J.

OIL ENGINES.

Mietz, Aug. .....New York.

OILS AND LUBRICANTS.

Dixon Crucible Co., Joseph..Jersey City, N. J.
Standard Oil Co.....Cleveland.

PACKING.

Crane Co. .....Chicago.
Jenkins Bros. .....New York.
Katzenstein, L. & Co.....New York.
New York Belting & Packing Co..New York.

PAINTS.

Baker, Howard H. & Co.....Buffalo.
Upson-Walton Co. .....Cleveland.

PATTERN SHOP MACHINERY.

Atlantic Works, Inc.....Philadelphia.

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WANTED and FOR SALE Department Continued.

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FOR SALE—Length 78 ft., beam 18 ft., triple expansion engines, water-tube boiler, allowed 200 lbs.; electric light, search light, mahogany deck-house 9 x 16, power launch, complete outfit, all in first-class condition. One of the best family cruising yachts on the Lakes. Inquire Wickes Bros., Saginaw, Mich. tf

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This up-to-date Gasoline Yacht 65x9½, mahogany finished throughout; large cabin, plate glass windows, mahogany blinds; fine carpets and upholstery; excellent electric light plant—dynamo, storage batteries and search light. Entire boat can be easily converted into cabin if desired.

Rapid fire yacht cannon; anchor, life preservers, flags, etc., complete. Very fast 4 cylinder, 4 cycle King engine of 50 h. p. Cost nearly $8,000, will sell at great bargain.

O. J. MULFORD, Stevens Bldg., Detroit.

Marine Boiler.

For Sale.—One 50 H. P. Scotch Marine Boiler, 10 ft. long, 78 in. diameter, 160 lbs. steam pressure. Manufactured by Ritter & Co, Buffalo, N. Y. In first-class shape. For particulars, write The Detroit Stove Works, Detroit, Mich. t. f.

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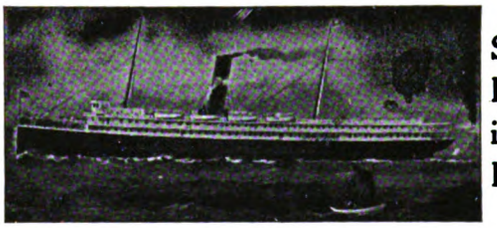

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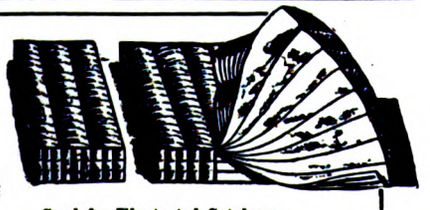

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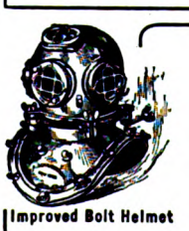

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Buyers' Directory of the Marine Trade.—*Continued.*

PILE DRIVING AND SUBMARINE WORK.

Buffalo Dredging Co.....Buffalo.
Chicago & Gt. Lakes Dredge & Dock Co. ..... Chicago.
Dunbar & Sullivan Dredging Co.....Buffalo.
Fitz-Simons & Connell Co.....Chicago.
Hickler Bros.....Sault Ste. Marie, Mich.
Lake Superior Contracting & Dredging Co. ..... Duluth, Minn.
Parker Bros. Co., Ltd.....Detroit.
Smith Co., L. P. & J. A.....Cleveland.
Starke Dredge & Dock Co., C. H..Milwaukee.
Sullivan, M..... Detroit

PIPE, WROUGHT IRON.

Bourne-Fuller Co.....Cleveland, O.
Crane Co. .....Chicago.
Macbeth Iron Co.....Cleveland.
Reading Iron Co.....Reading. Pa.

PLANING MILL MACHINERY.

Atlantic Works, Inc.....Philadelphia.

PLATES—SHIP, STRUCTURAL, ETC.

Bourne-Fuller Co.....Cleveland, O.
Otis Steel Co.....Cleveland.
Reading Iron Co.....Reading, Pa.

PRESSURE REGULATORS.

Kieley & Mueller .....New York.
Ross Valve Co.....Troy, N. Y.

PROPELLER WHEELS.

American Ship Building Co.....Cleveland.
Atlantic Works.....East Boston, Mass.
Cramp, Wm. & Sons.....Philadelphia.
Detroit Ship Building Co.....Detroit.
Fore River Shipbuilding Co.....Quincy, Mass.
Great Lakes Engineering Works.....Detroit.
Hyde Windlass Co.....Bath, Me.
Lockwood Mfg. Co. .....East Boston, Mass.
Marine Iron Works.....Chicago.
Milwaukee Dry Dock Co.....Milwaukee.
Newport News Ship Building Co..... .....Newport News, Va.
Roelker, H. B.....New York.
Sheriffs Mfg. Co.....Milwaukee.
Superior Ship Building Co....Superior, Wis.
Thropp & Sons Co., J. E.....Trenton, N. J.
Trout, H. G.....Buffalo.

PROJECTORS, ELECTRIC.

General Electric Co.....Schenectady, N. Y.

PUMPS FOR VARIOUS PURPOSES.

Blake, Geo. F., Mfg. Co.....New York.
Great Lakes Engineering Works.....Detroit.
Marine Iron Works.....Chicago.
Kingsford Foundry & Machine Works..... .....Oswego, N. Y.

RANGES.

Stamford Foundry Co.....Stamford, Conn.

REFRIGERATING APPARATUS.

Great Lakes Engineering Works.....Detroit.
Roelker, H. B.....New York.

REGISTER FOR CLASSIFICATION OF VESSELS.

Great Lakes Register.....Cleveland.

REPAIRS—ENGINE AND BOILER.

(See also Boiler Manufacturers and Engine Builders.)

Georgian Bay Engineering Works..... .....Midland, Ont.

RIVETS, STEEL FOR SHIPS AND BOILERS.

Bourne-Fuller Co.....Cleveland, O.

SAFETY VALVES.

Ashton Valve Co.....Boston.
Crane Co. .....Chicago.
Lunkenheimer Co. .....Cincinnati.

SAIL MAKERS.

Baker, Howard H. & Co.....Buffalo.
Upson-Walton Co.....Cleveland.

SALVAGE COMPANIES.

See Wrecking Companies.

SEARCH LIGHTS.

General Electric Co.....Schenectady, N. Y.

SHEARS.

See Punches, Rivets, and Shears.

SHIP AND BOILER PLATES AND SHAPES.

Bourne-Fuller Co.....Cleveland, O.
Otis Steel Co.....Cleveland.

SHIP BUILDERS.

American Ship Building Co.....Cleveland.
Atlantic Works .....East Boston, Mass.
Bertram Engine Works Co., Ltd.Toronto, Can.
Buffalo Dry Dock Co.....Buffalo.
Cramp, Wm. & Sons.....Philadelphia.
Craig Ship Building Co.....Toledo, O.
Chicago Ship Building Co.....Chicago.
Detroit Ship Building Co.....Detroit.
Fore River Shipbuilding Co.....Quincy, Mass.
Great Lakes Engineering Works.....Detroit.
Lockwood Mfg. Co.....East Boston, Mass.
Maryland Steel Co.....Sparrows Point, Md.
Milwaukee Dry Dock Co.....Milwaukee.
Newport News Ship Building Co..... .....Newport News, Va.
New York Shipbuilding Co....Camden, N. J.
Roach's Ship Yard.....Chester, Pa.
Shipowner's Dry Dock Co.....Chicago.
Smith & Son, Abram.....Algonac, Mich.
Willard, Chas. P. & Co. Winthrop Harbor, Ill.

SHIP CHANDLERS.

Baker, Howard H. & Co.....Buffalo.
Marine Mfg. & Supply Co.....New York.
Upson-Walton Co.....Cleveland.

SHIP DESIGNERS.

Kidd, Joseph .....Duluth.
Kreer & Parsons .....Chicago.
Matteson & Drake .....Buffalo.
Rice & Lovejoy .....Buffalo.
Steel, Nacey & Hynd.....Cleveland.
Wood, W. J.....Chicago.

SHIP LANTERNS AND LAMPS.

Russell & Watson.....Buffalo.

SHIPMATE RANGES.

Stamford Foundry Co.....Stamford, Conn.

SHIP TIMBER.

Martin-Barriss Co.....Cleveland.

SMOOTH-ON COMPOUND, FOR REPAIRS.

Smooth-On Mfg. Co.....Jersey City, N. J.

STAYBOLTS, IRON OR STEEL, HOLLOW OR SOLID.

Falls Hollow Staybolt Co..Cuyahoga Falls, O.
Reading Iron Co.....Reading, Pa.

STEAM VESSELS FOR SALE.

Gilchrist & Co., C. P.....Cleveland.
Holmes, Samuel .....New York.
Lester, S. S.....Quebec, Can.
McCarthy, T. R.....Montreal, Can.

STEAMSHIP LINES, PASS. AND FREIGHT.

American Line .....New York.
Anchor Line .....Buffalo.
Boston Steamship Co.....Boston.
International Mercantile Marine Co..... ..... Philadelphia.
New York & Cuba Mail S. S. Co...New York.
Red Star Line.....New York.
United Fruit Co.....Bostor

STEEL CASTINGS.

Otis Steel Co.....Cleveland.

STEERING APPARATUS.

American Ship Building Co.....Cleveland.
Chase Machine Co.....Cleveland.
Detroit Ship Building Co.....Detroit.
Hyde Windlass Co.....Bath, Me.
Marine Mfg. & Supply Co.....New York.
Moulton Steering Engine Co.....New York.
Sheriffs Mfg. Co.....Milwaukee.

SUBMARINE DIVING APPARATUS.

Morse & Son, A. J.....Boston.
Schrader's Son, A.....New York.

SURVEYORS, MARINE.

Gaskin, Edward .....Buffalo.
Hynd, Alexander .....Cleveland.
Lovejoy, H. O.....Buffalo.
Matteson & Drake .....Philadelphia.
Parker Bros. Co., Ltd.....Detroit.
Nacey, James .....Cleveland.
Rice, Henry .....Buffalo.
Steel, Adam .....Cleveland.
Wood, W. J.....Chicago.

TESTS OF MATERIALS.

Hunt, Robert W. & Co.....Chicago.
Lunkenheimer Co.....Cincinnati, O.

TOOLS, METAL WORKING, FOR SHIP AND ENGINE WORKS.

Watson-Stillman Co.....New York.

TOOLS, WOOD WORKING.

Atlantic Works, Inc.....Philadelphia.

TOWING MACHINES.

American Ship Windlass Co..Providence, R. I.
Chase Machine Co.....Cleveland.

TOWING COMPANIES.

Donnelly Salvage & Wrecking Co..... .....Kingston, Ont.

TRAPS, STEAM.

Kieley & Mueller .....New York.
Sturtevant Co., B. F.....Hyde Park, Mass.

TRUCKS.

Boston & Lockport Block Co.....Boston.

TUBING, SEAMLESS.

Shelby Steel Tube Co.....Pittsburg, Pa.

VALVES, STEAM SPECIALTIES, ETC.

Ashton Valve Co.....Boston.
Crane Co. .....Chicago.
Jenkins Bros. .....New York.
Kieley & Mueller.....New York.
Lunkenheimer Co.....Cincinnati.
Ross Valve Co.....Troy, N. Y.

VALVES FOR WATER AND GAS.

Lunkenheimer Co.....Cincinnati.
Ross Valve Co.....Troy, N. Y.

VARNISHES.

Detroit Varnish Co.....Detroit.
Detroit White Lead Works.....Detroit.
New Jersey Zinc Co.....New York.
Also Ship Chandlers.

VENTILATING APPARATUS FOR SHIPS.

Sturtevant, B. F. Co.....Hyde Park, Mass.

VESSEL AND FREIGHT AGENTS.

Boland, John J.....Buffalo.
Brown & Co.....Buffalo.
Elphicke, C. W. & Co.....Chicago.
Fleming & Co., E. J.....Chicago.
Gilchrist & Co., C. P.....Cleveland.
Hall, John B.....Buffalo.
Helm & Co., D. T.....Duluth.
Hawgood & Co., W. A.....Cleveland.
Holmes, Samuel .....New York.
Hutchinson & Co.....Cleveland.
Lester, S. S. .....Quebec, Can.
McCarthy, T. R.....Montreal.
Mitchell & Co.....Cleveland.
Parker Bros. Co., Ltd.....Detroit.
Prindiville & Co.....Chicago.
Richardson, W. C.....Cleveland.
Sullivan, D. & Co.....Chicago.

VESSEL FURNISHINGS.

Williams & Rodgers Co.....Cleveland.

WATER GAUGES.

Bonner & Co., Wm. T.....Boston.
Lunkenheimer Co.....Cincinnati, O.

WATERTIGHT BULKHEAD DOORS.

"Long Arm" System Co.....Cleveland.

WHISTLES, STEAM.

Ashton Valve Co.....Boston.
Lunkenheimer Co..... Cincinnati.

WILFORD'S WATERPROOF CLOTH.

Bunker, E. A. .....New York.

WIRE ROPE AND WIRE ROPE FITTINGS.

Baker, H. H. & Co.....Buffalo.
DeGrauw, Aymar & Co.....New York.
Upson-Walton Co.....Cleveland.

WINDLASSES.

American Ship Windlass Co..Providence, R. I.
American Ship Building Co.....Cleveland.
Hyde Windlass Co.....Bath, Me.
Marine Mfg. & Supply Co.....New York.

WINCHES.

American Ship Windlass Co..Providence, R. I.
Georgian Bay Engineering Works..... .....Midland, Ont.
Hyde Windlass Co.....Bath, Me.

WOOD PRESERVING PAINT.

Carbolineum Wood Preserving Co..Milwaukee.

WOOD WORKING MACHINERY.

Atlantic Works, Inc.....Philadelphia.

WRECKING AND SALVAGE COMPANIES.

Donnelly Salvage & Wrecking Co..... .....Kingston, Ont.
Parker Bros. Co., Ltd.....Detroit

YACHT AND BOAT BUILDERS.

Bertram Engine Works Co., Ltd..Toronto, Can.
Drein, Thos. & Son.....Wilmington, Del.
Georgian Bay Engineering Works..... .....Midland, Ont.
Truscott Boat Mfg. Co.....St. Joseph, Mich.
Willard, Chas. P. & Co..... .....Winthrop Harbor, Ill.

YACHT BROKERS.

Clapham & Clapham.....New York.

YAWLS.

Drein, Thos. & Son.....Wilmington, Del.

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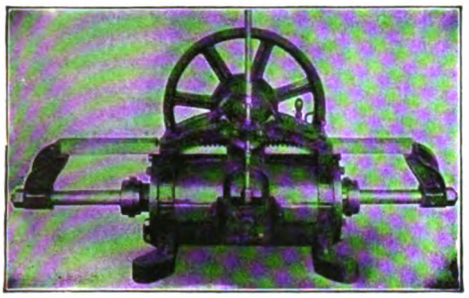

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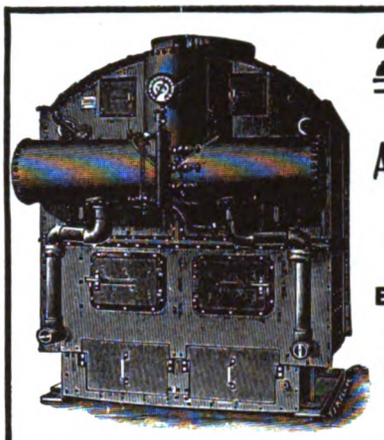

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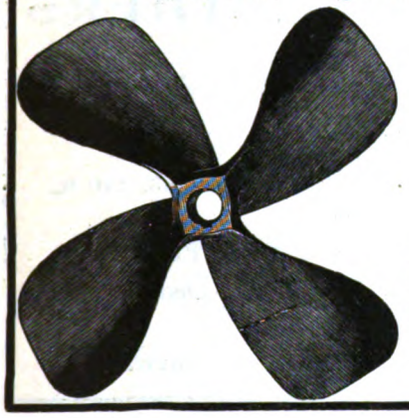

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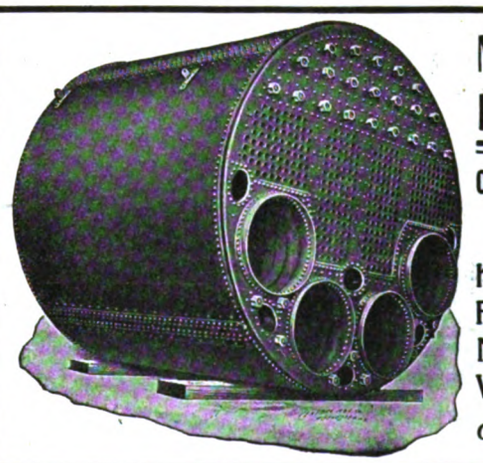

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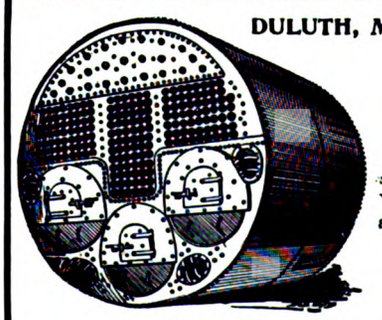

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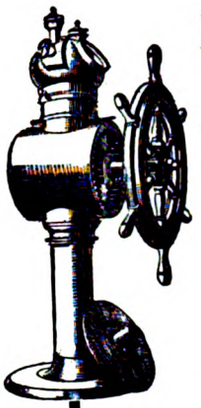

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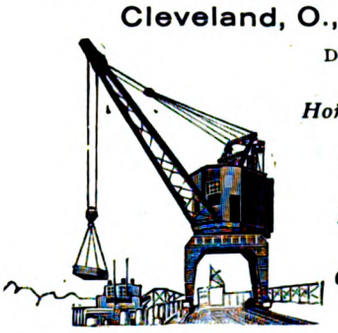

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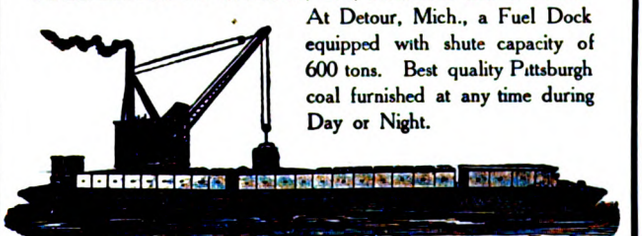

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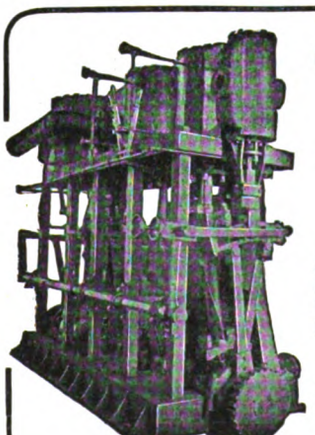

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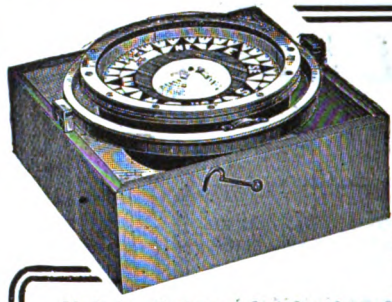

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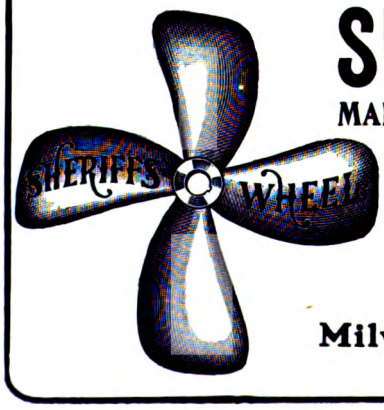

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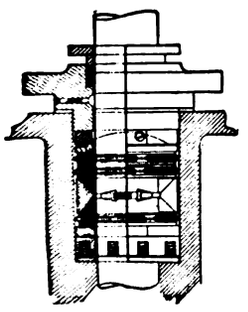

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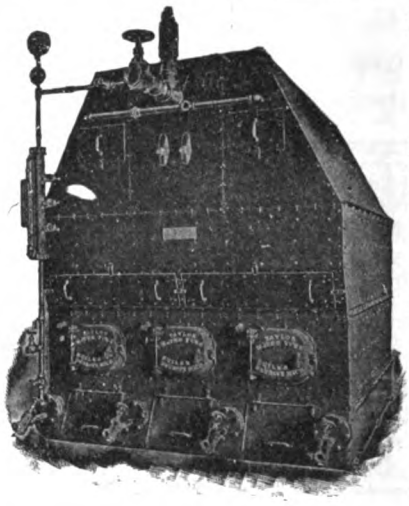

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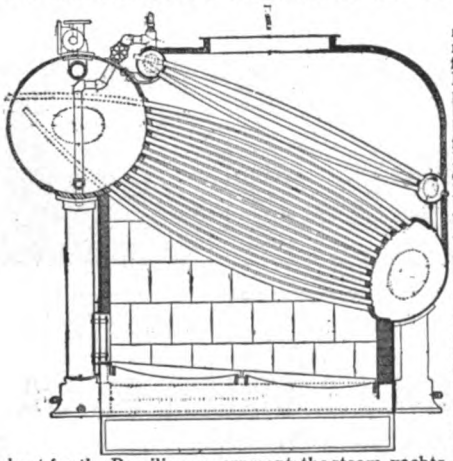

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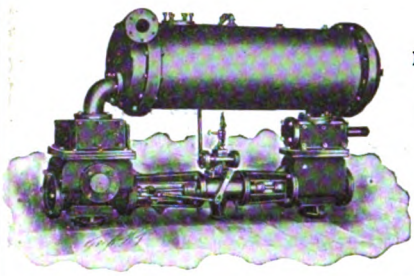

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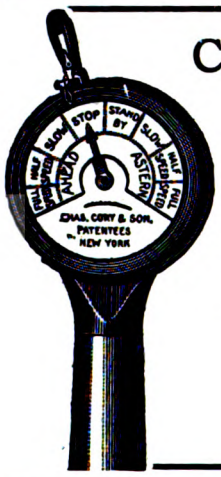

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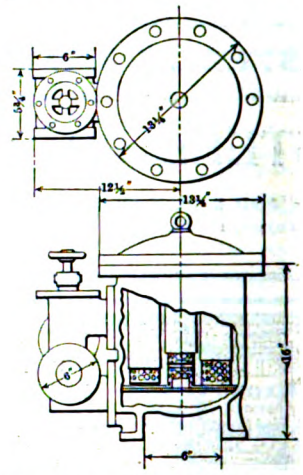

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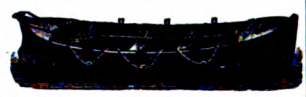

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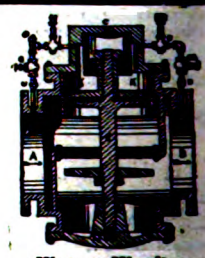

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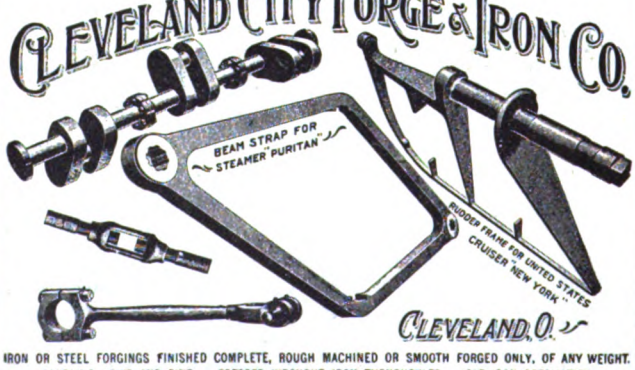

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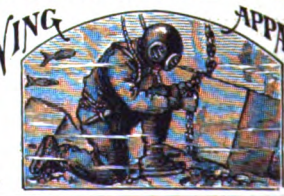

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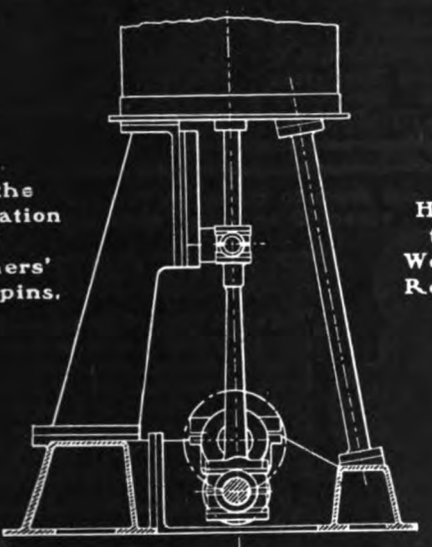

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No. 40, Toledo and Buffalo Accom	†10:00 a.m.	†10:30 a.m.
No. 32, Fast Mail	*11:25 a.m.	*11:30 a.m.
No. 48, Accommodation via Sandusky	†1:40 p.m.	.....
No. 42, Boston–New York Express	.....	*11:45 a.m.
No. 44, Cleveland and New York Spl.	.....	*3:00 p.m.
No. 46, Southwestern Express	.....	*3:10 p.m.
No. 116, Ashtabula Accommodation	.....	†4:30 p.m.
No. 6, Limited Fast Mail	*5:40 p.m.	*5:45 p.m.
No. 26, 20th Century Limited	*7:40 p.m.	*7:43 p.m.
No. 10, Chicago, N.Y. & Boston Spl.	*7:30 p.m.	*7:50 p.m.
No. 16, New England Express	*10:30 p.m.	*10:35 p.m.
No. 2, Day Express	†9:10 p.m.	†9:25 p.m.
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No. 11, Southwestern Limited	*2:55 a.m.	.....
No. 9, Day Express	.....	†6:00 a m.
No. 15, Boston and Chicago Special	*3:10 a.m.	*3:15 a.m.
No. 19, Lake Shore Limited	*7:15 a.m.	*7:25 a.m.
No. 23, Western Express	*10:30 a.m.	*10:35 a.m.
No. 29, Southwestern Special	‡11:10 a.m.	.....
No. 33, Southwestern Express	*12:25 p.m.	.....
No. 133, Cleveland and Detroit Exp.	.....	*12:45 p.m.
No. 47, Accommodation	†11:00 a.m.	†3:00 p m.
No. 141, Sandusky Accommodation	.....	†3:10 p.m.
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No. 127, Norwalk Accommodation	.....	†5:10 p.m.
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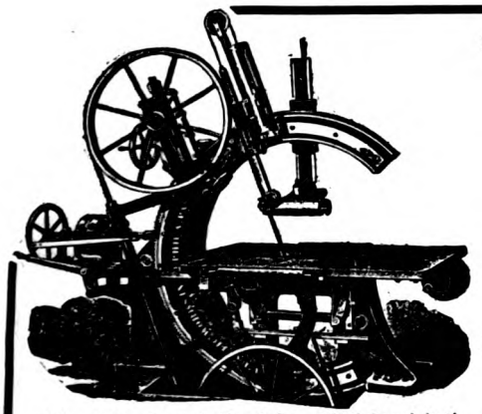

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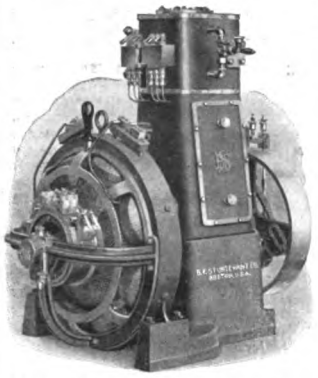

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Send for Bulletin 63.

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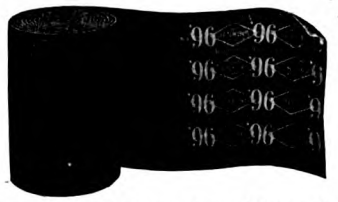

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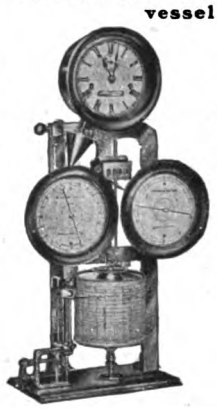

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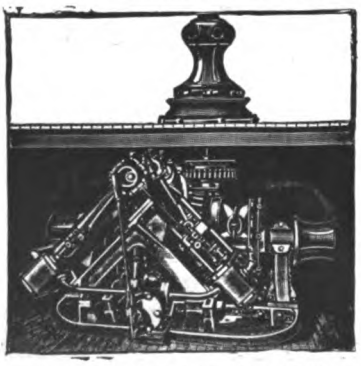

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